

XP
H947
V. 71
#5

PHYTOLOGIA

An international journal to expedite plant systematic, phylogeographical
and ecological publication

LIBRARY
NEW YORK
BOTANICAL
GARDEN

JAN 27 1992

Vol. 71

November 1991

No. 5

CONTENTS

- NESOM, G.L., Two new species of *Penstemon* subg. *Habroanthus* (Scrophulariaceae) from México333
- NESOM, G.L., A new species of *Leucophyllum* (Scrophulariaceae) from Nuevo León, México.....337
- TURNER, B.L., An overview of the North American species of *Menodora* (Oleaceae).....340
- NESOM, G.L., A new species of *Nama* (Hydrophyllaceae) from north-eastern México357
- JORDAN, R., Putative natural hybrid of *Eupatorium capillifolium* x *E. glaucescens* from Hardin County, Texas360
- LEMKE, D.E., The genus *Solanum* (Solanaceae) in Texas.....362
- BROWN, L.E. & J. SCHULTZ, *Arthraxon hispidus* (Poaceae), new to Texas.....379
- LUTHER, H.E., Two new species of *Aechmea* (Bromeliaceae).....382
- JONES, S.D., G.D. JONES, & J.K. WIPFF, *Kosteletzkya depressa*, section *Kosteletzkya* (Malvaceae), new to Texas387
- SORENG, R.J., Notes on new infraspecific taxa and hybrids in North American *Poa* (Poaceae).....390

Contents continued on the inside cover.

Published by Michael J. Warnock
185 Westridge Drive Huntsville, Texas 77340 U.S.A.
PHYTOLOGIA is printed on acid free paper.

(Contents continued)

NESOM, G.L. & M.A. BAKER, First report of <i>Erigeron velutipes</i> (Asteraceae) from the United States	414
NESOM, G.L., A new species of <i>Erigeron</i> (Asteraceae: Astereae) from northwestern New Mexico	416
ERTTER, B., New combinations in <i>Potentilla</i> and <i>Horkelia</i> (Rosaceae) in California	420
Books received	423
Corrections and additions	428

PHYTOLOGIA (ISSN 00319430) is published monthly with two volumes per year by Michael J. Warnock, 185 Westridge Drive, Huntsville, TX 77340. Second Class postage at Huntsville, TX. Copyright ©1991 by PHYTOLOGIA. Annual domestic individual subscription (12 issues): \$36.00. Annual domestic institutional subscription (12 issues): \$40.00. Foreign and/or airmail postage extra. Single copy sales: Current issue and back issues volume 67 to present, \$3.50; Back issues (previous to volume 67), \$3.00 (add \$.50 per copy postage and handling US [\$1.00 per copy foreign]). Back issue sales by volume: \$17.00 per volume 42-66 (not all available as complete volumes); \$21.00 per volume 67-present; add \$2.00 per volume postage US (\$4.00 per volume foreign). POSTMASTER: Send address changes to Phytologia, 185 Westridge Drive, Huntsville, TX 77340.

TWO NEW SPECIES OF *PENSTEMON* SUBG. *HABROANTHUS*
(SCROPHULARIACEAE) FROM MÉXICO

Guy L. Nesom

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

ABSTRACT

Two new species of *Penstemon* subg. *Habroanthus* are described from México: *P. luteus* (yellow flowered) from Coahuila and *P. galloensis* (blue flowered) from Nuevo León.

KEY WORDS: *Penstemon* subg. *Habroanthus*, Scrophulariaceae, México

Study of specimens recently collected in northeastern México by the Hinton family has revealed the existence of two previously undescribed species of *Penstemon*. The morphology of the anther sacs (dehiscing from the apices inward, usually leaving the central portion indehiscent) in both of these species places them in *Penstemon* subg. *Habroanthus* Crosswh. (Crosswhite 1967; Holmgren 1984). The taxonomic position of each species within the subgenus is discussed following its description.

Penstemon luteus Nesom, *sp. nov.* TYPE: MÉXICO. Coahuila. Mpio. Arteaga, Sierra El Coahuilón, scattered in pine woods, 3100 m, 17 Jun 1991, *Hinton et al.* 21009 (HOLOTYPE: TEX!).

Ex affinitate *Penstemoni* subg. *Habroanthi* Crosswh., imprimis proprius floribus tubularibus luteisque et inflorescentia floribus numerosis in pedunculis ac pedicellis longis.

Herbs 0.6 m tall; stems and leaves completely glabrous, eglandular, slightly glaucous. Leaves opposite, linear-lanceolate, entire, epetiolate, the uppermost (below the inflorescence) 6-8 cm long, 5-10 mm wide. Inflorescence a thyrses of ca. 20 verticillasters, not secund, the cymes 3-7 flowered on peduncles 4-6 cm long and pedicels 10-15 mm long; sepals green, lightly striate, 6-7 mm long, ovate-acuminate with entire margins; corollas yellow (as noted on the collector's label), drying yellow, apparently without other coloration, glabrous

outside, the palate sparsely villous with long, yellowish hairs, tubular, 25-35 mm long, gradually expanded, slightly if at all ventricose, ca. 8-10 mm wide at the throat, apparently without ventral grooves, strongly bilabiate, the lower lobes 7-8 mm long and strongly reflexed, the upper lobes 4-5 mm long and projecting past the lower; fertile stamens nearly reaching the throat but not exerted, the anther sacs glabrous, widely divergent, 3 mm long from tip to tip, dehiscent from the distal ends, leaving the proximal portion indehiscent and often slightly gibbous, the suture margins minutely sharp papillate; staminode glabrous, ca. half the length of the fertile stamens. Mature fruits not seen. Known only from the type collection, represented by a specimen with the inflorescence and upper portion (45 cm long) of a stem of a single plant.

All previously described species of subg. *Habroanthus* produce blue to red flowers. There is no other yellow flowered species of *Penstemon* in México, and such are rare within the genus over its entire range of geography and morphology. Even if the flowers of *P. luteus* were some other color, however, it still could not be identified as any previously known species. Besides *P. luteus*, *P. barbatus* (Cav.) Roth is the only other species of subg. *Habroanthus* that occurs in the high sierra of southeastern Coahuila. Plants of *P. barbatus* are generally smaller and produce flowers with red corollas in few flowered inflorescences on thinner stems, exerted stamens, and staminodes as long as the fertile stamens.

Penstemon subg. *Habroanthus* has been divided into two sections, based on flower color and morphology: sect. *Habroanthus* (= sect. *Glabri* [Rydb.] Pennell) produces ventricose, blue to violet flowers; sect. *Elmigeri* (Reichb.) Benth. produces tubular, gradually ampliate, red flowers. These differences apparently are correlated with hummingbird pollination in sect. *Elmigeri* vs. wasp pollination in sect. *Habroanthus* (Crosswhite 1967). *Penstemon luteus* represents a third mode of variation within subg. *Habroanthus*, and although its yellow, tubular flowers are probably hummingbird pollinated, it justifiably could be accorded sectional status on a phenetic basis, since flower color is the primary distinction between the two previously recognized sections. It is not clear, however, that the relatively few species of sect. *Elmigeri* represent a monophyletic group (Crosswhite 1965, 1976), and *P. luteus* may itself have been derived from a red flowered ancestor. *Penstemon barbatus* (the type of sect. *Elmigeri*) hybridizes with the blue flowered species *P. laevis* Pennell, *P. speciosus* Dougl. ex Lindl., and *P. leiophyllus* Pennell of sect. *Habroanthus* as well as with *P. palmeri* A. Gray of subg. *Penstemon* (Holmgren 1984).

Penstemon sect. *Elmigeri*, which has not been the subject of a study or even a recent taxonomic summary (not even by Crosswhite 1965 or 1967), comprises eight species: *P. barbatus*, *P. wislizeni* (A. Gray) Straw, *P. imberbis* (Willd.) Poir., *P. labrosus* (A. Gray) Hook., *P. eatonii* A. Gray, *P. cardinalis* Woot. & Standl., *P. regalis* A. Nels. (or *P. cardinalis* subsp. *regalis* [A. Nels.] Nisbet & Jackson), and *P. henricksonii* Straw. *Penstemon barbatus* occurs from central

México northward to Coahuila and Texas and to Durango, Chihuahua, and the southwestern United States; *P. wislizeni*, *P. imberbis*, and *P. henricksonii* are endemic to México (Straw 1959, 1976); *P. labrosus* occurs in California and Baja California Norte, and the last three species are restricted to the southwestern United States. Apart from the two species described in the present paper, all the species of sect. *Habroanthus* are restricted to the western United States.

Penstemon galloensis Nesom, *sp. nov.* TYPE: MÉXICO. Nuevo León. Mpio. Galeana, Cerro El Gallo, oak woods, 2100 m, 16 Aug 1987, *Hinton et al.* 19166 (HOLOTYPE: TEX!).

Penstemoni barbato (Cav.) Roth similis sed differt floribus azureis, sepalis ovatis marginibus denticulatis, antherarum sacculis paginis dense minute papillatis, et staminodio apice papillato longitudine ca. 2/3 staminum partes aequanti.

Perennial herbs ca. 0.6 m tall; stems and leaves completely glabrous, eglandular. Leaves opposite, the cauline linear-lanceolate, 7-10 cm long 2.5-4.0 mm wide, the basal oblanceolate to spatulate, 10-12 cm long, the blades 10-22 mm wide. Inflorescence a thyrse of ca. 8 verticillasters, apparently not secund, the cymes 2-3 flowered on peduncles 2-4 cm long and pedicels 1-2 cm long; sepals greenish, glabrous, ovate-deltate-acuminate with denticulate-serrulate margins, lightly striate, the lobes 6-7 mm long; corollas purple, ventrally whitish, with dark purple stripes running onto the lower lip, glabrous outside, lightly bearded on the palate and proximal portions of the lower lobes, 27-30 mm long, tubular, slightly ventricose, apparently without prominent ventral grooves, ca. 5-6 mm wide at the throat, strongly bilabiate, the upper lobes 7-8 mm long, the lower lobes 6-7 mm long and strongly reflexed; fertile stamens definitely exerted from the corolla tube, the anther sacs densely and minutely papillate, widely divergent, 4 mm long from tip to tip, dehiscent from the distal ends, leaving the proximal third of each sac indehiscent and often slightly gibbous, the suture margins smooth; staminode distinctly papillate at the apex, ca. 2/3 the length of the fertile stamens. Mature fruits not seen. Known only from the type collection.

Penstemon galloensis is similar in its vegetative morphology and strongly bilabiate corollas to *P. barbatus*, but the sepals of the latter are triangular, the corollas red, the anther sacs smooth, and the staminode equaling the length of the fertile stamens, without a papillate apex. In Crosswhite's taxonomic arrangement of subg. *Habroanthus* (1967), *P. galloensis* would be placed with other blue flowered species in sect. *Habroanthus* series *Habroanthus*. The other species of this group are restricted to the western United States, and the evolutionary relationship of *P. galloensis* to these is not clear. The new species is compared here in the Latin diagnosis to *P. barbatus* because the latter is

the only putatively related species, besides *P. luteus*, that grows in northeastern México. In a key that includes the majority of the related taxa of sect. *Habroanthus* in the western United States (Holmgren 1984), *P. galloensis* runs with difficulty to the vicinity of *P. speciosa* Dougl. ex Lindl., the most widely distributed species of the section, and *P. laevis* Pennell. These are perhaps closely related to the new species, but both differ from it in their more compact inflorescences, flowers with broader throats, and smooth anther sacs that are sigmoidally twisted.

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner, Dr. Andrew McDonald, and Dr. T.P. Ramamoorthy for their review and comments on the manuscript.

LITERATURE CITED

- Crosswhite, F.S. 1965. Hybridization of *Penstemon barbatus* (Section *Elmiger*) with species in section *Habroanthus*. Southw. Naturalist 10:234-237.
- . 1967. Revision of *Penstemon* section *Habroanthus* (Scrophulariaceae). Amer. Midl. Naturalist 77:1-41 (I: Conspectus, pp. 1-11; II: Series *Speciosi*, pp. 12-27; III: Series *Virgati*, pp. 28-41).
- . 1970. Revision of *Penstemon* (Section *Leptostemon*) Series *Racemosi*. Amer. Midl. Naturalist 84:237-243.
- Holmgren, N. 1984. *Penstemon*. Intermountain Fl. 4:370-455.
- Straw, R.M. 1959. Los *Penstemon* de México. I. Sobre la confusión entre *Penstemon lanceolatus* y *Penstemon imberbis*. Bol. Soc. Bot. Méx. 24:39-52.
- . 1976. A new species of *Penstemon* (Scrophulariaceae) from Mexico. Madroño 23:263-265.

A NEW SPECIES OF *LEUCOPHYLLUM* (SCROPHULARIACEAE) FROM
NUEVO LEÓN, MÉXICO

Guy L. Nesom

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

ABSTRACT

Leucophyllum hintoniorum *sp. nov.* is described from eastern Nuevo León, México, near Aramberri. It is distinctive in its obovate-oblongate, concolorous leaves densely invested with nearly sessile dendritic trichomes, uniseriate glandular trichomes extending above the remainder of the vestiture, and purple flowers with yellow spots and eciliate corolla lobes.

KEY WORDS: *Leucophyllum*, Scrophulariaceae, México

Study of specimens recently collected in Nuevo León by the Hinton family has revealed the existence of a remarkably distinctive and previously undescribed species of *Leucophyllum*. The genus is known to harbor narrow endemics (Henrickson & Flyr 1985), and it is not surprising to discover yet another.

Leucophyllum hintoniorum Nesom, *sp. nov.* TYPE: MÉXICO. Nuevo León. Mpio. Aramberri, E of Aramberri, gypsum hillside, 1300 m, 14 May 1991, *Hinton et al.* 20929 (HOLOTYPE: TEX!; Isotype: MEXU!).

Leucophyllo flyrii B. Turner similis foliis concoloris obovato-oblongatisque, calycis lobis stipitati-glandulosis, et corollis glandulosis purpureisque sed differt foliis longioribus, vestimento trichomatibus brevi-stipitatis dendriticisque, pedicellis ac calycum vestimento pariter confertis, et corollis sparsim minute glandulosis flavi-maculatis in tubo inferno.

Alternately branched shrubs ca. 1 m tall, apparently not thorny. Silvery vestiture completely obscuring the stem, leaf, and calyx surfaces, of a dense layer of relatively uniform dendritic trichomes on short stipes (less than 0.1

mm high), with fewer, conspicuous, barely stipitate dendritic trichomes with much longer and thicker radii projecting above the basal layer; young stems, leaves, and calyces densely invested with prominent stipitate glands on uniseriate stipes 0.3-0.5 mm long and extending well above the remainder of the vestiture, these apparently persistent only on the calyces. Leaves alternate, entire, obovate-oblongate, broadest in the distal one-fourth, 20-35 mm long, 5-11 mm wide at the broadest point, obtuse at the apex, gradually tapered to the base, without a clear petiole. Flowers with tomentose pedicels 2-3 mm long; calyces 6.0-6.5 mm long, lobes lanceolate, 5 mm long, 1.2 mm wide, densely invested with dendritic hairs and stipitate-glandular trichomes, sparsely glandular inside but without dendritic hairs; corollas purple, with yellow spots on the lower tube, 16-20 mm long, tube broadly ampliate, to 7 mm wide at the throat (pressed), sparsely pilose on inside floor with crinkled hairs 1-2 mm long, sparsely stipitate-glandular on the outside, the lobes obovate, subequal, 6-7 mm long and wide, emarginate, eciliate, nearly glabrous inside; stamens 4, anthers and filaments glabrous; styles 10-12 mm long, sparsely pilose; ovaries glandular at the apex, otherwise glabrate. Mature capsules not seen. Known only from the type collection.

Leucophyllum hintoniorum is similar to *L. flyrii* B. Turner (to which it will key in Henrickson & Flyr 1985) in its concolorous, obovate-oblongate leaves without a clear petiole, persistently stipitate-glandular calyx lobes, the glands extending well above the other vestiture, and purple corollas glandular on the outside. The new species differs from *L. flyrii* in its longer leaves (20-35 mm long vs. 10-27 mm long), distinctive vestiture of barely stipitate dendritic hairs (vs. tall dendritic hairs), pedicels and calyx with equally dense vestiture (vs. more dense on the pedicels), and corollas sparsely and minutely glandular (vs. relatively densely and long stipitate glandular) on the outside, with yellow (vs. purple) spots on the lower tube. As noted by Henrickson & Flyr (1985), the relationships of *L. flyrii* are obscure, and although it is compared here with *L. hintoniorum* because of their distinctive stipitate glandularity that does not occur elsewhere in the genus, the two species do not appear to be closely related.

Three other species occur in the same area of southern Nuevo León as *Leucophyllum hintoniorum*: *L. frutescens* (Berland.) I.M. Johnston, *L. pruinosum* I.M. Johnston, *L. revolutum* Rzed., and *L. zygophyllum* I.M. Johnston. All of these are immediately different from *L. hintoniorum* in leaf morphology as well as other features. The new species is clearly different from the widespread and variable *L. frutescens*, which has lavender to pink corollas with ciliate lobes and distinctly bicolored leaves with a vestiture of dendritic trichomes with relatively longer axes, lacking stipitate glandular trichomes.

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner and Dr. T.P. Ramamoorthy for their review and comments on the manuscript.

LITERATURE CITED

- Henrickson, J. & L.D. Flyr. 1985. Systematics of *Leucophyllum* and *Eremogeton* (Scrophulariaceae). Sida 11:107-172.

AN OVERVIEW OF THE NORTH AMERICAN SPECIES OF *MENODORA* (OLEACEAE)

B.L. Turner

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

ABSTRACT

A systematic overview of the North American species of *Menodora* is presented, including a key to the fourteen species recognized. Distribution maps are provided for all species, including varieties. Four new species are proposed, all of which are restricted to México: *M. hintoniorum* B. Turner, a gypsophile from Nuevo León; *M. jaliscana* B. Turner, from Jalisco and Michoacán; *M. potosiensis* Henrickson *ex* B. Turner, from San Luis Potosí; and *M. tehuacana* B. Turner, from Puebla and Oaxaca. One new combination is proposed: *M. magniflora* (Steerm.) B. Turner.

KEY WORDS: *Menodora*, Oleaceae, México

Steermark (1932) provided a revision of the genus *Menodora* as part of the requirements for a Masters Degree program at Washington University, St. Louis. In this, he recognized seventeen species: ten occurring in North America; five in South America; and two in Africa.

Steermark's presentation was an excellent one for its time, especially since there were relatively few collections from North and South America in the fifteen herbaria from which he obtained loans. Unfortunately, his study was not based upon knowledge of populational variation in the field; additionally, he failed to provide carefully constructed distributional maps for the taxa concerned.

The present overview of the North American species has been prepared so as to provide a backdrop for the description of the several new taxa proposed here. My personal experience with populational variation in the field has been largely with the Texas species, namely *Menodora heterophylla* Moric. *ex* A. DC., *M. longiflora* Engelm. *ex* A. Gray, and *M. scabra* Engelm. *ex* A. Gray. Limited though this was, it proved critical in my interpretation of the

intraspecific categories proposed by Steyermark and, by extrapolation, my evaluation of specific categories in general.

The distributional maps included here are based upon approximately 1000 specimens from the following herbaria (numbers shown in parenthesis): F (64); GH (239); LL (200); MEXU (101); MO (60); TEX (386).

KEY TO NORTH AMERICAN SPECIES OF *MENODORA*

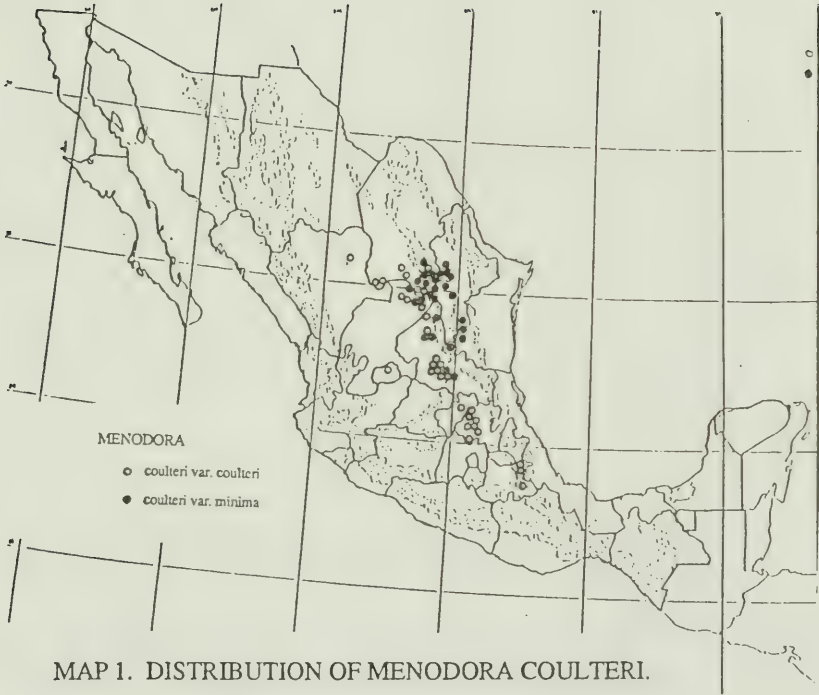
1. Fruiting pedicels to some extent recurved or arcuate.(2)
1. Fruiting pedicels stiffly erect.(9)
 - 2.(1) Leaves deeply lobed, mostly 1-3 cm wide. *M. heterophylla*
 2. Leaves mostly entire, 0.1-1.0 cm wide.(3)
- 3.(2) Stems deeply sulcate, at least some of the lower leaves 3 parted; central Oaxaca. *M. mexicana*
3. Stems rounded, not deeply sulcate, the leaves entire; Oaxaca to Nuevo León.(4)
 - 4.(3) Leaves linear lanceolate to oblong lanceolate, mostly 1-3 mm wide, (4-)5-7 times as long as wide.(5)
 4. Leaves mostly ovate to elliptical oblong; 4-12 mm wide; 3-4(-5) times as long as wide.(6)
- 5.(4) Stems stiffly erect, 15-40 cm high, intricately branched below; leaves opposite throughout; Nuevo León, gypseous soils. *M. hintoniorum*
5. Stems spreading from the base, 3-15 cm high, the stems not intricately branched, leaves mostly alternate (rarely not); widespread. *M. coulteri*
 - 6.(4) Stems hirtellous-scabrous or scabrous-puberulent, the hairs mostly somewhat reflexed and only 0.10-0.15 mm long.(7)
 6. Stems hirsute-pilose with mostly spreading hairs 0.2-0.5 mm long.(8)
- 7.(6) Suffruticose spreading herbs 5-20 cm high; leaf blades minutely but markedly glandular punctate above and below (under magnification); Oaxaca to Guanajuato. *M. helianthemoides*
7. Suffruticose stiffly branched subshrubs 30-70 cm high; leaf blades scarcely, if at all, glandular punctate; Jalisco and Michoacán. *M. jaliscana*
 - 8.(6) Corolla lobes 12-14 mm long. *M. magniflora*

8. Corolla lobes 8-10 mm long; southern Puebla and adjacent Oaxaca.
..... *M. tehuacana*
- 9.(2) Plants spinose. *M. spinescens*
9. Plants not spinose. (10)
 - 10.(9) Corolla tubes elongated, 25-55 mm long. *M. longiflora*
 10. Corolla tubes short, 2-16 mm long. (11)
- 11.(10) Stems with upper leaves markedly reduced, the latter mostly linear and short (1-10 mm long), rarely a few leaves well developed. (12)
11. Stems with upper leaves not markedly reduced, leafy throughout, the leaves gradually reduced upwards. (14)
 - 12.(11) Lower leaves well developed, the upper leaves rather abruptly much reduced. *M. scabra*
 12. Lower (and upper) leaves all much reduced or similarly developed. (13)
- 13.(12) Lower leaves, at least some of them, 3 parted; corollas 8-15 mm long.
..... *M. intricata*
13. Lower leaves simple; corollas ca. 20 mm long. *M. potosiensis*
 - 14.(11) Midstems terete-angulate, not strongly 5 sulcate; leaves mostly alternate above; widespread. *M. scabra*
 14. Midstems strongly 5 sulcate; leaves mostly opposite above; San Luis Potosí. *M. potosiensis*

Menodora coulteri A. Gray. Map 1.

This widespread variable species is divisible into two seemingly intergrading, regional, varieties as follows:

- A. Petal lobes mostly 4-5(-6) mm long; primary stems mostly low and somewhat procumbent; se Coahuila, s Nuevo León, ne Zacatecas, and n San Luis Potosí. var. *minima*
- A. Petal lobes mostly 7-10 mm long; primary stems mostly erect or ascending; e Durango and se Coahuila, s to Puebla. var. *coulteri*



Menodora coulteri A. Gray var. *coulteri*. Map 1. *Menodora coulteri* A. Gray, Amer. J. Sci. II. 14:44. 1852. TYPE: MÉXICO. Hidalgo: Zimapan, w/o date, *Coulter 938* (HOLOTYPE: GH!).

Menodora helianthemoides Humb. & Bonpl. var. *engelmannii* Steyermark, Ann. Missouri Bot. Gard. 19:119. 1932. TYPE: MÉXICO. Coahuila: valley near Saltillo, 7 May 1848, *Gregg 44* (HOLOTYPE: MO!; Isotype: GH!).

As indicated below, this taxon is only weakly differentiated from var. *minima* Steyermark. Type material of var. *engelmannii* appears to approach var. *minima*, at least in habit.

Menodora coulteri A. Gray var. *minima* Steyermark, Ann. Missouri Bot. Gard. 19:121. 1932. Map 1. TYPE: MÉXICO. Zacatecas: vicinity of Cedros, "near Arroyas," Jun 1908, *J.E. Kirkwood 20* (HOLOTYPE: MO!; Isotype: F!).

The var. *minima* is largely distinguished from var. *coulteri* by corolla size and habit, as noted in the key. The taxa appear to intergrade in regions of contact. Additionally, small flowered forms of what otherwise appears to be typical var. *coulteri* occasionally occur far removed from regions of contact.

Menodora helianthemoides Humb. & Bonpl., *Pl. Aequin.* 2:98. 1809. Map 2. TYPE: MÉXICO. Hidalgo: *Bonpland 4114* (HOLOTYPE: P, microfiche!; Isotype: G-DC, microfiche!).

Menodora helianthemoides Humb. & Bonpl. var. *parviflora* Greenman, Proc. Amer. Acad. Arts 34:569. 1899. TYPE: MÉXICO. Hidalgo: bare hills above Pachuca, 2591 m, 30 Jul 1896, *Pringle 6918* (HOLOTYPE: MO!; Isotypes: F!, GH!, MEXU!).

Typification of this species was apparently misinterpreted by Steyermark (1932) in his revisionary treatment of the group. Not having seen type material of *Menodora helianthemoides*, he applied the name to material with hirsute-pilose pubescence from near Tehuacan, Puebla, which I treat as a distinct species. Actually, Dr. Carol Todzia, on a recent visit to the Humboldt collections at P, kindly verified that the type material of *M. helianthemoides*, obtained from the Pachuca area of Hidalgo, is glandular punctate and essentially glabrous, the minutely scabridulous pubescence largely confined to the midribs and margins of the glandular punctate leaves. Steyermark included such material in his broad concept of *M. coulteri*.



Menodora heterophylla Moric. ex A. DC., *Prodr.* 8:316. 1844. Map 2. TYPE: UNITED STATES. Texas: between Laredo and San Antonio, 1828, *Berlandier 1461* (HOLOTYPE: G-DC, microfiche!; Isotypes GH!, MO!).

Menodora pinnatifida Mart., *Ann. Sci. Nat. Bot.* III. 19:365. 1853. *Bolivaria pinnatifida* (Mart.) Schlecht., *Linnaea* 26:474. 1853. TYPE: UNITED STATES. Texas: w/o locality, w/o date, *Lindheimer*, w/o number. Martins described this taxon from seed material grown in the Royal Botanical Garden in Monaco from seed obtained from *Lindheimer* in 1852. Typification must await examination of original collections, if any, but there can be little doubt as to the application of the name.

This is a very distinct, albeit highly variable, species, readily recognized by its herbaceous habit and relatively broad, mostly deeply lobed leaves. It is common in the U.S.A. but relatively rare in México.

According to Steyermark, the species is represented in Africa by populations referable to var. *australis* Steyermark.

Menodora hintoniorum B. Turner, *sp. nov.* Map 2.

Menodora scabrae Engelm. ex A. Gray similis sed capsulia in pedicellis recurvatis portatis et corollis minoribus differt.

TYPE: MÉXICO. Nuevo León: Mpio. Galeana, above La Berra, 2100 m, gypsum hillside, 12 Sep 1989, *Hinton et al. 19679* (HOLOTYPE: TEX!).

Suffruticose shrublets to 40 cm high. Midstems mostly terete and striate, nearly leafless, minutely scabridulous, arising from an intricately branched basal complex of woody branches. Leaves mostly opposite throughout, linear lanceolate to narrowly oblanceolate, mostly 10-15 mm long, 1-2 mm wide, glabrous or nearly so. Calyx lobes 8, mostly 5-6 mm long. Corollas yellow or tinged with red, 5-6 mm long, the tubes ca. 1.5 mm long, the lobes 3.5-4.5 mm long. Capsules (immature) ca. 2 mm across, the fruiting pedicels sharply recurved.

The species superficially resembles *Menodora scabra*, but the latter has capsules borne on erect pedicels. It might also be confused with *M. intricata* T. Brandege, but the latter has markedly angulate, glabrous or glabrate stems.

Menodora intricata T. Brandege, *Univ. Calif. Publ. Bot.* 4:380. 1913. Map 2. TYPE: MÉXICO. San Luis Potosí: near Minas de San Rafael, May 1911, *Purpus 5016* (HOLOTYPE: UC; Isotypes: GH! [2 sheets], MO!).

Menodora intricata T. Brandege var. *purpusii* Steyermark, Ann. Missouri Bot. Gard. 19:150. 1932. TYPE: MÉXICO. Puebla: mountains about Tehuacan, Jun 1905, *Purpus 1318* (HOLOTYPE: MO!; Isotypes: F!, GH!).

Because of its strongly sulcate stems and often trilobed leaves, an easily recognized species. The var. *purpusii* has been applied to dwarf growth forms with markedly hispidulous stems and foliage, but otherwise it much resembles typical *Menodora intricata*.

Menodora jaliscana B. Turner, *sp. nov.* Map 2.

Menodora helianthemoides H.B.K. similis sed plantis rigide erectis subfruticosis 30-40 cm altis caulibus divaricate ramosis et foliis tenuioribus fere epunctatis differt.

TYPE: MÉXICO. Jalisco: Mpio. de Tecalitlán, Cerca de Gallardo, 10 km NW of Tepalcatepec, Michoacán. "Ladera ignea con vegetación de bosque tropical deciduo," 500 m, 26 Oct 1963, J. Rzedowski 17503 (HOLOTYPE: MICH!).

Low, divaricately branched, shrubs 30-70 cm high. Stems striate-terete, densely hispidulous with minute retrorse hairs. Leaves opposite throughout, those at midstem, elliptic to ovate elliptic, 18-22 mm long, 9-12 mm wide, clearly, but weakly, pinnately veined, minutely pubescent along the midveins and margins, otherwise glabrous, weakly glandular punctate, if at all, the apices acute or apiculate. Flowers axillary, borne on arcuate peduncles which reflex in fruit. Calyx 7-8 mm long, the lobes oblanceolate, 8-12 mm long, the apices narrowly apiculate. Corollas (in bud) ca. 9 mm long, the tube ca. 2 mm long. Capsules ca. 6 mm across; seeds absent from the old fruits.

ADDITIONAL SPECIMEN EXAMINED: MÉXICO. Michoacán: ca. 3 km NW of Tepalcatepec, along the road to Jilotlán, Jalisco, ca. 400 m, 18 Oct 1982, *Villaseñor Rios 291* (MEXU).

This is a very distinct taxon readily distinguished from its closest relative, *Menodora helianthemoides*, by its large, erect, divaricately branched habit and larger, mostly opposite, epunctate, apiculate leaves.

Menodora longiflora Engelm. ex A. Gray, Amer. J. Sci. II. 14:45. 1852. Map 3. *Menodoropsis longiflora* (Engelm. ex A. Gray) Small, *Fl. S.E. U.S.*, ed. 1. 1903. TYPE. UNITED STATES. Texas: high plateaus of upper Guadalupe River, Jun 1847, *Lindheimer 652* (LECTOTYPE (selected here): GH!; Isolectotypes: GH!, MO!).

Menodora pubens A. Gray, Amer. J. Sci. II. 14:45. 1852. TYPE: UNITED STATES. New Mexico: Grant Co., Copper Mines, 19 Aug 1851, *Wright 1696 (310)* (HOLOTYPE: GH!; Isotype: GH!).

Menodora hispida Palmer, J. Arnold Arb. 10:43. 1929. TYPE: UNITED STATES. Texas: Jeff Davis Co., Limpia Canyon, near Ft. Davis, 8 Oct 1926, *E.J. Palmer 32112* (HOLOTYPE: AA!).

This is a widespread variable species, especially in habit and vestiture. I have found both glabrous and densely short pilose plants growing within 30 meters of each other at a given site (e.g., Pecos Co., Texas, *Turner 15972*, TEX). Pubescent forms have been given the names *Menodora pubens* and *M. hispida*, as noted in the above synonymy, and by Steyermark, who treated them similarly.

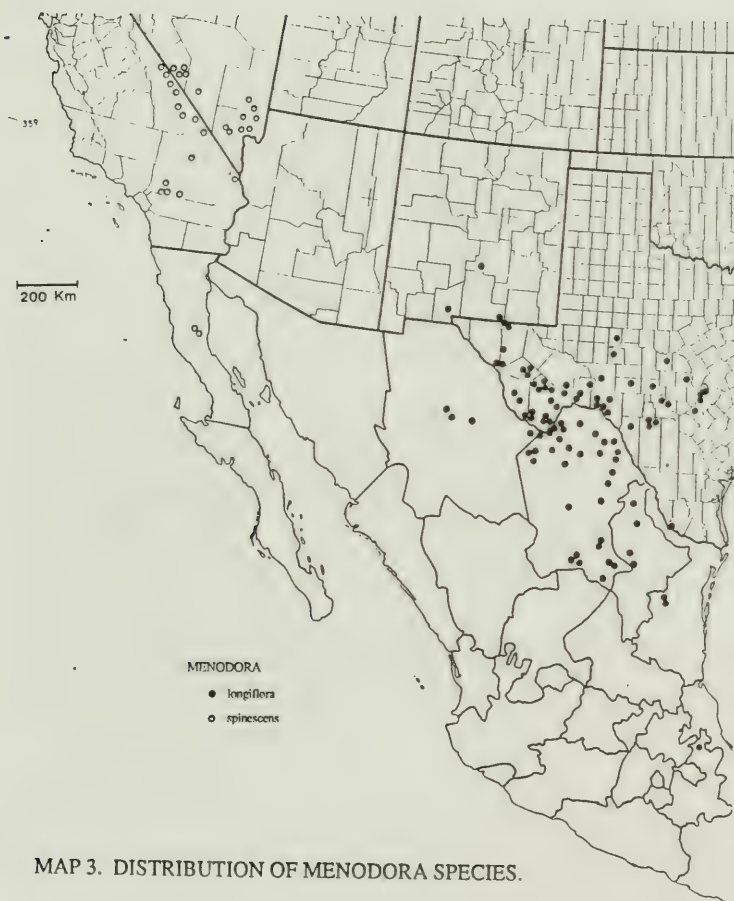
The isolated collection of *Menodora longifolia* from Puebla shown on Map 3 is based upon a collection from Acatzingo (*Arsène 10*, F). The collection may be in error as to locality.

Menodora magniflora (Steyermark) B. Turner, *comb. & stat. nov.* Map 4. BASIONYM: *Menodora helianthemoides* Humb. & Bonpl. var. *magniflora* Steyermark, Ann. Missouri Bot. Gard. 19:118. 1932. TYPE: MÉXICO. San Luis Potosí: region of San Luis Potosí, 1878, *Parry & Palmer 570* (HOLOTYPE: MO!; Isotype: GH!).

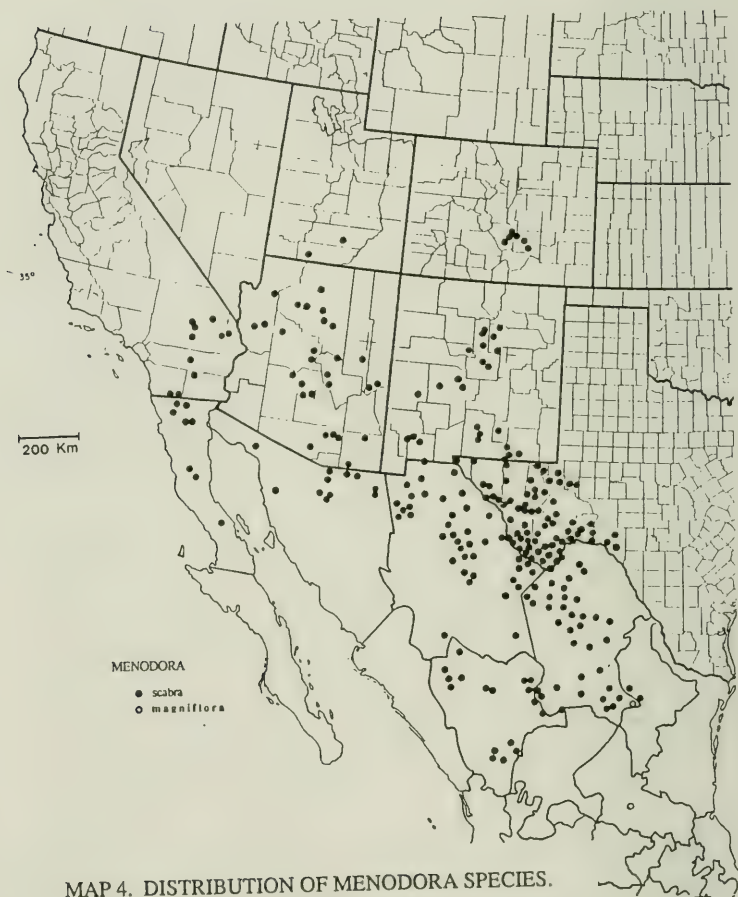
Menodora helianthemoides Humb. & Bonpl. var. *humilis* Steyermark, Ann. Missouri Bot. Gard. 19:118. 1932. TYPE: MÉXICO. San Luis Potosí: region of San Luis Potosí, 1878, *Parry & Palmer 571* (HOLOTYPE: MO!; Isotypes: F!, GH!). -

Steyermark related this taxon to *Menodora helianthemoides* (presumably because of his taxonomic misconceptions of the latter) but it appears, on growth habit and vestiture, closer to *M. tehuacana* B. Turner. It differs from the latter in having a less divaricately branched habit, leaves with more gradually narrowed acute apices (vs. abruptly broadly rounded to obtuse apiculate), larger corollas (ca. 20 mm long vs. 8-15 mm) and more sharply recurved fruiting pedicels (vs. weakly arcuate). Steyermark described the pubescence of *M. magniflora* as "scaberulentus" but observation of type material shows the pubescence to be more nearly pilose.

The holotype of *Menodora helianthemoides* var. *humilis* appears to be a depauperate form of *M. magniflora*. It is inexplicably mixed with specimens of *M. coulteri* var. *minima*, all bearing the collection number *Parry & Palmer 571*.



MAP 3. DISTRIBUTION OF MENODORA SPECIES.



Except for type materials, the species is known to me by only one other recent collection (Coahuila: Mpio. Ramos Arizpe, Sierra San José de Los Nuncios, 19 Jul 1991, *Hinton et al.* 21048, TEX). The latter collection is described as a shrub 0.5 m high, but appears not to differ appreciably from typical forms.

Menodora mexicana (A. DC.) A. Gray, Amer. J. Sci. II. 14:45. 1852. BASIONYM: *Bolivaria mexicana* A. DC., Prodr. 8:315. 1844. TYPE: MÉXICO. Oaxaca: vicinity of Oaxaca City, Jul 1834, *G. Andrieux* 228 (HOLOTYPE: G-DC, microfiche!; Photoholotype: MO!).

This poorly known taxon appears to be most closely related to *Menodora tehuacana*, differing from the latter in having strongly sulcate stems and acute, glabrous, subcoriaceous leaves. The type (G-DC) was kindly examined at my request by Dr. Carol Todzia and she informs me that the stems are strongly sulcate (as in *M. intricata*) and minutely scabridulous, not wholly glabrous as originally described. The latter characters suggest a relationship with *M. intricata*, which is readily distinguished, however, by its erect capsules.

Menodora mullerae I.M. Johnston, J. Arnold Arb. 16:451. 1935. TYPE: MÉXICO. Nuevo León: "cedar savannah above encinal wheatfields, about 15 miles SW of Galeana," ca. 7500-8000 ft, 19 May 1943, *C.H. & M.T. Mueller* 463 (HOLOTYPE: AA!; Isotypes: F!, MEXU!, MICH!).

This taxon belongs to the species complex having fruits on recurved pedicels. It is superficially similar to *Menodora coulteri* but is readily distinguished by its stiffly acute, rather nervose leaves, and larger corollas, the tube 10-16 mm long (vs. 3-6 mm).

Menodora potosiensis Henrickson *ex* B. Turner, *sp. nov.*

Menodora longiflora Engelm. *ex* A. Gray sed tubis corollarum tantum 2-5 mm longis et caulibus valde 5 angulatis differt.

TYPE: MÉXICO. San Luis Potosí: 5 km NW of Tierra Nueva, 1750 m, "ladera riolítica con vegetación de matorral xerófilo," 9 Jun 1959, *J. Rzedowski* 10787 (HOLOTYPE: TEX!; Isotypes: MEXU!, MICH!).

Stiffly erect suffruticose herbs to 45 cm high. Stems clearly 5 angled, the vestiture of minutely scabrous reflexed hairs, glabrate with age. Leaves mostly opposite throughout, gradually reduced upwards, if at all, the blades mostly narrowly ovate, uninervate, the margins entire, minutely scabrous to glabrate.

Calyces 7-10 mm long, the lobes 8-11, linear lanceolate. Corollas yellow, 15-20 mm long, the tubes pubescent within, 3-5 mm long, the lobes ca. 15 mm long. Fruits glabrous, the orbicular units ca. 7 mm across at maturity.

ADDITIONAL SPECIMENS EXAMINED: MÉXICO. San Luis Potosí: 2 mi S of the road junction to Loudres, along the road from Querétaro to San Luis Potosí, 21° 46' x 100° 44', 1800 m, 29 Jun 1972, *Chiang et al.* 8137 (LL); San Luis Potosí, 1879, *Schaffner* 506 (F,MO).

This taxon is closely related to *Menodora scabra* but is readily distinguished by its strongly 5 angled stems, larger corollas, and larger fruits. It superficially resembles *M. coulteri*, the latter readily distinguished by its recurved pedicels.

Menodora scabra Engelm. ex A. Gray, Amer. J. Sci. II. 14:44. 1852. Map 4.

TYPE: UNITED STATES. New Mexico: Santa Fe Co., Ojo del Muerto, 2 Aug 1846, *Wislizenus* 68 (HOLOTYPE: GH!; Isotype: MO!).

Menodora scabra Engelm. ex A. Gray var. *glabrescens* A. Gray in S. Watson, *Cat. Pl. Wheeler Exp.* 15. 1874. TYPE: UNITED STATES. Arizona: w/o locality, *Wheeler s.n.* (GH).

Menodora scoparia Engelm. ex A. Gray, *Bot. Calif.* 1:471. 1876. TYPE: MÉXICO. Coahuila: mountains about Saltillo, Sept 1848, *Gregg* 527 (HOLOTYPE: GH!; Isotype: MO!).

Menodora laevis Wootton & Standley, Contr. U.S. Natl. Herb. 16:158. 1913. *Menodora scabra* Engelm. ex A. Gray var. *laevis* (Wootton & Standley). Steyermark, Ann. Missouri Bot. Gard. 19:137. 1932. TYPE: UNITED STATES. New Mexico: Doña Ana Co., Organ Mountains, Aug 1881, *Vasey s.n.* (HOLOTYPE: US; Isotype: GH!).

Menodora scabra Engelm. ex A. Gray var. *ramosissima* Steyermark, Ann. Missouri Bot. Gard. 19:139. 1932. TYPE: UNITED STATES. Texas: El Paso Co., near El Paso, 19 Jun 1926, *E.J. Palmer* 31083 (HOLOTYPE: MO!).

Menodora scabra Engelm. ex A. Gray var. *longituba* Steyermark, Ann. Missouri Bot. Gard. 19:141. 1932. TYPE: UNITED STATES. Arizona. "Massatzal Mountains," 5 May 1867, *Smart* 213 (HOLOTYPE: GH!; Isotype: GH!).

Menodora decemfida (Gill) A. Gray var. *longifolia* Steyermark, Ann. Missouri Bot. Gard. 19:143. 1932. TYPE: MÉXICO. Durango: Santiago Papasquiaro, Apr-Aug 1896, *E. Palmer* 429 (HOLOTYPE: MO!; Isotypes: F!,GH!).

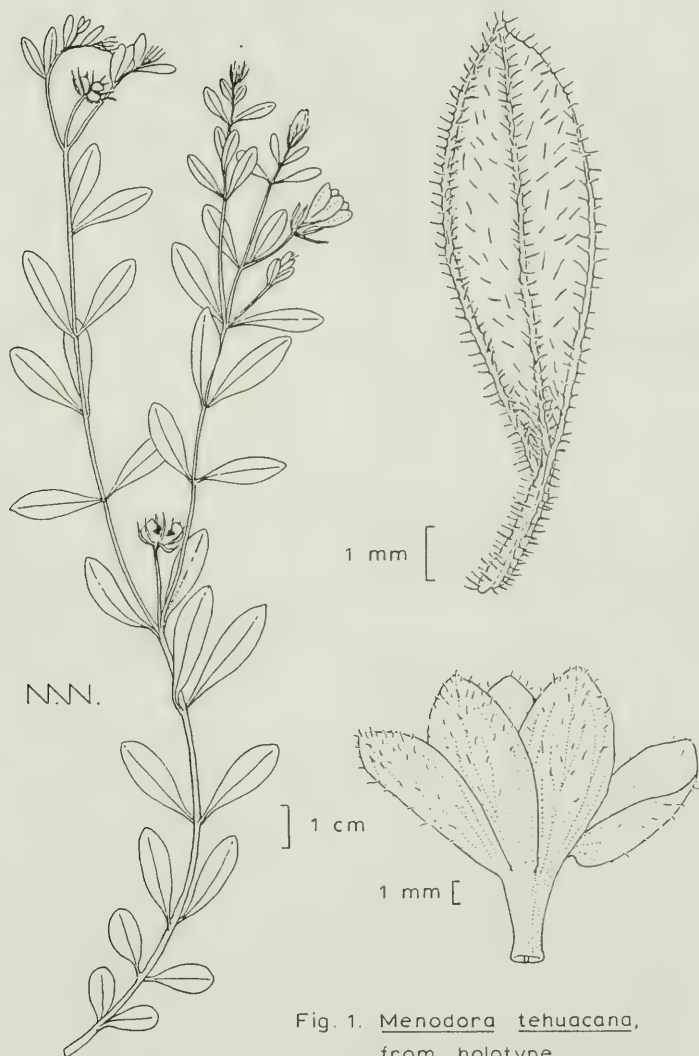


Fig. 1. *Menodora tehuacana*,
from holotype.

Menodora scabra is a widespread, highly variable species, which is attested by the fact that three of the four varieties recognized by Steyermark were said by him to occur in El Paso County, Texas, a relatively arid region without much elevational or climatic variation. The species shows much variation in habit, leaf arrangement, and vestiture, as well as corolla size. Thus, populations from Texas, while mostly with relatively small alternate upper leaves, may occasionally have larger mostly opposite upper leaves.

Because of the considerable vegetative variation within *Menodora scabra*, I have included those plants with relatively narrow, sharply acute leaves which Steyermark referred to as *M. decemfida* var. *longifolia* in synonymy here. Steyermark's treatment of the latter within the broad rubric of his mostly South American species, *M. decemfida*, is largely suspect on geographical grounds, although *Menodora* is clearly noteworthy in its propensity to have peculiarly distributed taxa. Type material of the var. *longifolia* possesses relatively narrow leaves with acute apices, but otherwise differs but little from my concept of *M. scabra*.

The relatively poorly developed, rather fragmentary holotype of *Menodora scoparia* from near Saltillo, México, appears to differ not at all from *M. scabra*. Indeed, plants referred to *M. scoparia* by Steyermark are readily matched by forms of the latter from remote sites in the U.S.A. (e.g. from Texas to California). Apparently, when early, unbrowsed new shoots arise from the ligneous tap roots the leaves are rather large and plentiful, becoming progressively reduced up the stem. When heavily grazed or cropped, the secondary lower stems become slender and often stiffly imbricate, most of these producing very reduced or acicular leaves. Except for habit, these can not be distinguished from rather typical forms of *M. scabra* that occur near or with the intricately branched, subshrubby forms. Such forms from trans-Pecos Texas (Terrell Co., Correll 29889; Pecos Co., Cory 35193; Brewster Co., Turner 1116) and elsewhere (e.g., Arizona and México) have been variously annotated by previous workers as either *M. scabra* or *M. scoparia*, depending on leaf reduction along the upper stems.

Henrickson, by annotation of sheets at TEX, has identified a number of plants from trans-Pecos Texas and adjacent México with stiffly erect stems and reduced leaves, as a distinct species with the epithet "*chihuahuensis*." Such plants are very similar to what Steyermark called *Menodora scoparia* or *M. decemfida* var. *longiflora*; I include both of the latter within my concept of *M. scabra*. Watson (1876), in his original description of *M. scoparia*, noted that "It probably passes into *M. scabra*." Indeed, in a recent visit to Burro Mesa in the Big Bend National Park, I observed forms clearly referable to *M. scabra*, *M. scoparia*, and "*M. chihuahuensis*" all growing within 50 meters of each other along the paved road at the base of the Mesa (Turner 16029, A, B, C, TEX). As noted on the collector's label, narrow leafed, taller plants tended to occur in the shade of shrubs or among grasses; shorter plants with broader

leaves occurred in full sun; a broad range of intermediates occurred. Other than size and variation in leaf shape the plants were indistinguishable.

Menodora spinescens A. Gray, Proc. Amer. Acad. Arts 7:388. 1867. Map 3.
TYPE: UNITED STATES. Nevada: SE part of Nevada, 1865 (1866?),
Anderson s.n (HOLOTYPE: GH!).

Menodora spinescens A. Gray var. *mohavensis* Steyermark, Ann. Missouri Bot. Gard. 19:155. 1932. TYPE: UNITED STATES. California: San Bernardino Co., 14 mi NE of Barstow, 23 Apr 1925, *S.B. Parish 9795* (UC).

A very distinct taxon, not reported for México by Steyermark, but subsequently collected in Baja California (e.g., 1.5 mi SE of Sauzalito, *Moran 15386*, LL).

Menodora tehuacana B. Turner, *sp. nov.* Figure 4.

Menodora helianthemoides H.B.K. similis sed plantis herbaceis suffruticosis vel subfruticosis 20-70 cm altis et foliis dense pilosis admodum epunctatisque differt.

TYPE: MÉXICO. Puebla: 1.5 km E of Tehuacan, "rumbo a Coxcatlán. Matorral xerófilo. Cerros calizos.," 6 Aug 1981, *Fernando Chiang C. 2239*. (HOLOTYPE: TEX!; Isotype: MEXU).

Suffruticose erect herbs or subshrubs (8-)20-75 cm high. Stems densely pilose with spreading hairs, the latter mostly 0.4-0.8 mm long. Leaves mostly opposite throughout, 15-30 mm long, 5-12 mm wide (except in depauperate forms), moderately pilose on both surfaces, the apices abruptly rounded to obtuse and apiculate, drying dark green, weakly, if at all, glandular punctate. Corollas 10-15 mm long, yellow, the tubes 2-3 mm long, the lobes 8-10 mm long. Capsules 6-8 mm across, the fruits borne on slender, somewhat recurved (scarcely arcuate) pedicels, the latter mostly 6-12 mm long.

REPRESENTATIVE SPECIMENS EXAMINED: MÉXICO. Puebla: 6 km SW Tehuacan, 2 Sep 1979, *Chiang C. F-330* (MEXU); 11 km ESE of Tehuacan, ca. 1850 m, 9 Jun 1985, *Chiang C. et al. F-2603* (MEXU,MO); El Riego, Jun 1905, *Purpus 1319* (F,GH,MO); near San Luis Tultitlanapa, Jun 1908, *Purpus 3392* (F,GH); Tehuacan, 25 May 1945, *Miranda 3484* (MEXU); west of Tehuacan on La Mesa above El Riego, limestone area with gray to white soils, ca. 1500 m, Jul 1961, *Smith et al. 4123* (F,GH,MEXU); Mpio. Zapotitlán, Cerro localizado a 700 m al N del poblado de Zapotitlán, 1 Aug 1990, *Valiente 741* (MEXU).

This taxon was included by Steyermark in his concept of *Menodora helianthemoides* var. *helianthemoides*, at least to judge from his description and annotations. The species is apparently common about Tehuacan and readily distinguished from yet other taxa in this region.

ACKNOWLEDGMENTS

I am grateful to Dr. Guy Nesom for the Latin diagnoses; to him and Dr. T.P. Ramamoorthy for reviewing the manuscript; and to Dr. Carol Todzia for making critical examination of selected type material of *Menodora helianthemoides* and *M. mexicana*.

LITERATURE CITED

- Steyermark, J.A. 1932. A revision of the genus *Menodora*. Ann. Missouri Bot. Gard. 19:87-176.

A NEW SPECIES OF *NAMA* (HYDROPHYLLACEAE) FROM NORTHEASTERN MÉXICO

Guy L. Nesom

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

ABSTRACT

Nama hintoniorum *sp. nov.* is described from eastcentral Nuevo León, México. On the basis of vegetative and seed morphology, it is most closely similar to *N. bartlettii* and a group of other species primarily of northeastern México.

KEY WORDS: *Nama*, Hydrophyllaceae, México

Identification of recent collections made in northeastern México has revealed the following new species.

Nama hintoniorum Nesom, *sp. nov.* TYPE: MÉXICO. Nuevo León: Mpio. Aramberri, N of Aramberri, oak woods above river, 985 m, 1 Sep 1990, *Hinton et al.* 20564 (HOLOTYPE: TEX!; Isotype: MEXU!).

Namae bartlettii Standley similis sed habitu erecto, caulibus ad basim ligneis, inflorescentiis floribus numerosis, sepalis lanceolatis, et corollis rotatis differt.

Erect or ascending-erect, perennial herbs ca. 0.3 m tall, roots not seen, the stems winged, basally woody, minutely stipitate glandular, densely invested with spreading to ascending, eglandular hairs, these more or less of two size classes, the longer mostly 0.8-1.1 mm long, the shorter mostly 0.2-0.5 mm long. Leaves alternate, obovate, entire, plane or the margins narrowly revolute, 15-40 mm long, 4-12 mm wide at midstem, basally attenuate and narrowly decurrent 2-10 mm along the stem, stipitate glandular, the upper surface with two size classes of eglandular hairs, the larger with swollen bases, the hairs of more even length beneath. Flowers 4-12 in definite, terminal or axillary cymes, peduncles and pedicels filiform, the pedicels 2-5 mm long; calyx divided nearly to the base, not adnate to the ovary, the lobes herbaceous, linear lanceolate to linear

elliptic, 7-8 mm long (in fruit), glandular and coarsely hirsute; corollas purple, 6-7 mm long, broadly tubular-obconic, somewhat rotate; stamens included, unequally inserted, the filaments ca. 3 mm long, free portions longer than the winged adnate portions; styles ca. 2 mm long, the basal 0.2-0.3 mm adnate, free above. Capsule ovoid, 4-5 mm long, hispidulous. Seeds numerous, with deep alveoli in regularly aligned rows, the radial walls of the reticulum perforated.

Additional collection examined: MÉXICO. Nuevo León: Mpio. Zaragoza, along road from Rancho La Encantada to Zaragoza, pine-chaparral-palmetto association, 1800-1900 m, 4 Jul 1988, *Patterson 5948* (TEX).

The seeds of *Nama hintoniorum* (mounted and cleared in Hoyer's Solution, studied with a compound light microscope) have deeply alveolate-reticulate surfaces, the radial walls of the alveoli perforated, placing the new species in "Seed Group 3," as delimited by Chance & Bacon (1984). This group comprises *N. bartlettii* Standley, *N. palmeri* A. Gray ex Hemsl., *N. propinquum* Mort. & Hitchc., *N. marshii* (Standl.) I.M. Johnston, *N. stenocarpum* A. Gray, *N. biflorum* Choisy, and *N. jamaicense* L. (see comments in Bacon 1974 regarding *N. jamaicense* and *N. biflorum*; Bacon & Chance apparently regarded the two as conspecific). Among this group of species, *N. hintoniorum* is most similar to *N. bartlettii* in its duration, vestiture, leaf shape, pedicellate flowers, and seed morphology. *Nama bartlettii* differs in its prostrate-ascending habit, more herbaceous stems, fewer flowered inflorescences, tubular flowers (not rotate), and sepals that broaden toward the apex. The following key distinguishes *N. hintoniorum* from the other oblanceolate or spatulate leaved species of "Seed Group 3," all of which occur in northeastern México.

1. Perennial, erect; inflorescence 4-12 flowered, flowers on filiform pedicels; Nuevo León, México. *N. hintoniorum*
1. Annual or perennial, prostrate to ascending; inflorescence 1-2(-3) flowered or if more, the flowers sessile or nearly so. (2)
 2. Annual; leaves mostly spatulate; sepals lanceolate; flowers white. (4)
 2. Perennial; leaves mostly oblanceolate; sepals narrowly oblanceolate; flowers blue to purple. (3)
3. Leaves green (not sericeous), the pubescence spreading; flowers 2-3 per inflorescence, on filiform pedicels 10-14 mm long; Tamaulipas, México. *N. bartlettii*
3. Leaves sericeous, the pubescence mostly appressed; flowers 5-8 per inflorescence, sessile or on thick pedicels no more than 2 mm long; México (Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Zacatecas, Hidalgo). *N. palmeri*

4. Sepals (fruiting) 8-11 mm long, with a raised indurated keel on the proximal half; mature capsules 5-6 mm long; flowers solitary, on pedicels 1-3 (very rarely to 8) mm long; widespread in the southern U.S.A., México, West Indies, and South America. : *N. jamaicense*
4. Sepals (fruiting) 4-7 mm long, herbaceous; mature capsules 3.0-3.5 mm long; flowers (1-)2(-3), on peduncles and pedicels totaling 10-20 mm long; México (Nuevo León, Tamaulipas, and San Luis Potosí).
 *N. biflorum*

ACKNOWLEDGMENTS

I thank Dr. B.L. Turner and Dr. A. McDonald for their review and comments on the manuscript.

LITERATURE CITED

- Bacon, J.D. 1974. Chromosome numbers and taxonomic notes in the genus *Nama* (Hydrophyllaceae). *Brittonia* 26:101-105.
- Chance, G.D. & J.D. Bacon. 1984. Systematic implications of seed coat morphology in *Nama* (Hydrophyllaceae). *Amer. J. Bot.* 71:829-842.

PUTATIVE NATURAL HYBRID OF *EUPATORIUM CAPILLIFOLIUM* X *E.*
GLAUDESCENS FROM HARDIN COUNTY, TEXAS

Ray Jordan

326 Live Oak Lane, Port Arthur, Texas 77642 U.S.A.

ABSTRACT

At a site in Hardin County, Texas, *Eupatorium capillifolium* and *E. glaucescens* were found growing together. A single putative F_1 hybrid was also found. Morphological and pollen staining data strongly support the conclusion that the plant concerned is a hybrid.

KEY WORDS: *Eupatorium*, interspecific hybrids, Texas

During collection of plants from Hardin County, Texas, I encountered *Eupatorium capillifolium* (Lam.) Small (one of several species of dog fennel) and *E. glaucescens* Ell. growing together at the following site:

Lance Rosier Unit of Big Thicket, 0.6 mi E of Saratoga along highway 770, then S on dirt road 0.7 mi to fork, then left 1 mi; Growing in mixed pine-hardwood forest, 12 Oct 1991.

Only a single specimen of a putative hybrid between these two, clearly demarcated species, was found. A comparison of the salient features which distinguish the two species and putative hybrid follows.

Clearly, most of the distinguishing features are compromised in the putative hybrid, which is probably an F_1 , to judge from the fact that only a single plant was found, the pollen from which appeared mostly sterile (*i.e.*, nonstaining for cytoplasmic development).

DISCUSSION

Eupatorium capillifolium, is a widespread weed in the southeastern U.S.A., and occasionally introduced elsewhere in tropical or subtropical regions (B. Turner, pers. comm.), and yet other dog fennels are reported to hybridize among themselves and with the very distinct, *E. perfoliatum* L. Sullivan

	<i>E. capillifolium</i>	Putative hybrid	<i>E. glaucescens</i>
Midstem leaves:	compound with linear divisions	simple, deeply lobed or lacerate	simple, serrate
Capitulescence:	racemes	subglomerate racemes	glomerate
Involucral bracts:	glabrous, nonatomiferous	sparsely pubescent sparsely atomiferous	densely pubescent, atomiferous
Involucral bract apices:	acute apiculate	obtuse-apiculate	obtuse or rounded
Corolla throats:	tubular	tubulocampanulate	campanulate

(1976b) did not report hybrids involving either species reported here, but she did refer (1976a) to hybrids observed by other workers in which *E. capillifolium* was a parent. The present contribution is apparently the first report of a natural hybrid between *E. capillifolium* and *E. glaucescens*.

It should also be noted that Shinnars, in October of 1955, collected natural hybrids between *Eupatorium capillifolium* and *E. serotinum* Michx. in Shelby County, Texas, where they occurred with both parents (voucher numbers 22357, 22358, and 22359, TEX). Additional hybrids between *E. capillifolium* and these and yet other species of *Eupatorium* are likely to be found.

ACKNOWLEDGMENTS

I am grateful to Dr. Guy Nesom and Dr. B.L. Turner for help with the present paper. Vouchers are on deposit at TEX.

LITERATURE CITED

- Sullivan, V.I. 1976a. Diploidy, polyploidy, and agamospermy among species of *Eupatorium* (Compositae). *Canad. J. Bot.* 54:2907-2917.
- . 1976b. Putative hybridization in the genus *Eupatorium* (Compositae). *Rhodora* 80:513-527.

THE GENUS *SOLANUM* (SOLANACEAE) IN TEXAS

David E. Lemke

Department of Biology, Southwest Texas State University, San Marcos, Texas
78666 U.S.A.

ABSTRACT

This revised floristic treatment of *Solanum* in Texas incorporates additions to the flora as well as several nomenclatural changes. A key and revised descriptions are provided for all Texas species, including the following taxa not treated by Correll & Johnston: *S. citrullifolium* var. *setigerum*, *S. davisense*, *S. heterodoxum* var. *setigeroides*, *S. interius*, *S. sarrachoides*, and *S. tenuipes*.

KEY WORDS: *Solanum*, Solanaceae, Texas, floristics

Solanum, with more than 1400 species, is one of the largest genera of flowering plants and is distributed throughout the world. The greatest number of species is found in tropical America, but many species occur in temperate America and Africa as well (D'Arcy 1973).

Correll & Johnston (1970) recognized 20 species of *Solanum* in Texas; however, more recent treatments of infrageneric taxa in *Solanum* (Edmonds 1972; Heiser *et al.* 1979; Whalen 1979; Schilling 1981) have rendered Correll & Johnston's treatment obsolete. The present work provides a revised key and descriptions to facilitate the identification of the 24 species of nightshades currently known from Texas.

Solanum L.

(Ours) annual or perennial herbs, erect, trailing or scandent shrubs, or small trees, prickly or unarmed. Leaves simple and entire to bipinnatifid or odd pinnate, with or without interstitial leaflets, petiolate, exstipulate but occasionally with pseudostipular leaves. Inflorescences cymose or racemose, axillary or terminal and becoming lateral. Flowers perfect, actinomorphic or somewhat zygomorphic. Calyx 5(6) lobed, occasionally accrescent and closely

investing the fruit, not inflated. Corolla 5 lobed, plaited in bud, rotate or stellate, blue to purple, less often yellow, rarely white. Stamens 5, connivent, the anthers equal or dimorphic, dehiscent by apical pores and sometimes also by longitudinal slits. Style entire or capitate. Fruit a usually 2 celled berry containing numerous seeds, in some species also with oval concretions of stone cells (sclerotic granules) among the seeds.

KEY TO TEXAS SPECIES OF *SOLANUM*

1. Calyx with stramineous spinelike prickles. (2)
1. Calyx lacking prickles, although these may be present on stems and leaves.
..... (10)
 2. Corolla yellow. 5. *S. rostratum*
 2. Corolla violet to blue or white. (3)
3. Anthers all approximately equal in length; calyx free from the fruit. . (4)
3. Anthers of two size classes, the four uppermost subequal, the lower one longer and declined against the corolla; calyx closely investing the fruit.
..... (7)
 4. Pubescence at least in part of stellate hairs. (5)
 4. Stellate hairs absent. 1. *S. capsicoides*
5. Stems and lower leaf surface silvery canescent due to the dense stellate indumentum. 2. *S. elaeagnifolium*
5. Stems and lower leaf surface not as above, the pubescence not so dense.
..... (6)
 6. Leaves deeply pinnatifid. 3. *S. sisymbriifolium*
 6. Leaves more or less entire to merely lobed. 4. *S. campechiense*
7. Lower anther 6 mm or more long; corolla more than 1.5 cm across; stigma entire or only very slightly capitate. (8)
7. Lower anther 5 mm or less long; corolla less than 1.5 cm across; stigma capitate. 6. *S. heterodoxum*
 8. Perennials from a woody or corky base; seeds plump. 9. *S. tenuipes*
 8. Taprooted annuals; seeds flattened. (9)
9. Lower anther 6-8 mm long; corolla to 1.7 cm across. 8. *S. davisense*

9. Lower anther 10 mm or more long; corolla more than 2 cm across.
..... 7. *S. citrullifolium*
10. Pubescence of lower leaf surface and stems all or chiefly composed
of stellate or dendritic hairs. (11)
10. Pubescence of the lower leaf surface and stems composed entirely
of simple hairs or occasionally lacking. (15)
11. Herbage unarmed. (12)
11. Herbage prickly. (13)
 12. Leaves ovate to ovate elliptic, densely tomentose with stellate hairs;
inflorescence terminal. 10. *S. erianthum*
 12. Leaves narrowly elliptic to oblanceolate, moderately pubescent with
dendritic hairs; inflorescence lateral. 11. *S. capsicastrum*
13. Stems and lower leaf surface silvery canescent due to the dense pubescence.
..... 2. *S. elaeagnifolium*
13. Stems and lower leaf surface not as above, the typically tawny pubescence
not so dense. (14)
 14. The 4 to 8 rayed stellate hairs sessile on lower leaf surface; fruit 1-2
cm in diameter. 12. *S. carolinense*
 14. At least some of the usually 8 or more rayed stellate hairs stipitate
on lower leaf surface; fruit 2.5-3.0 cm in diameter. 13. *S. dimidiatum*
15. Leaves odd pinnate. (16)
15. Leaves simple. (18)
 16. Pubescence of young stems glandular; corolla stellate, white; leaflets
linear oblong to oblong lanceolate; pseudostipular leaves similar to
the regular leaves. 14. *S. jamesii*
 16. Pubescence not glandular; corolla rotate to rotate stellate, light
purple or rarely white; leaflets ovate to ovate elliptic or obovate;
pseudostipular leaves semiovate. (17)
17. Plant essentially glabrous; interstitial leaflets minute or lacking.
..... 15. *S. leptosepalum*
17. Plant more or less strigose; interstitial leaflets usually prominent.
..... 16. *S. fendleri*
18. Leaves deeply pinnatifid. 17. *S. triflorum*

- 18. Leaves entire or merely sinuate, sometimes hastately lobed. ..(19)
- 19. Plants woody perennials, erect or scandent shrubs or subshrubs; leaves typically oblong or hastately ovate.(20)
- 19. Plants annual or perennial herbs; leaves typically ovate.(21)
 - 20. Leaves broadest at or above the middle, tapered at base.
 - 18. *S. pseudocapsicum*
 - 20. Leaves broadest below the middle, not tapered at base.
 - 19. *S. triquetrum*
- 21. Anthers 2.6-4.9 mm long; style usually exerted at least 1 mm beyond the anthers; strong perennials.20. *S. douglasii*
- 21. Anthers 1.2-2.6 mm long; style barely, if at all, exerted beyond the anthers; annuals or short lived perennial herbs.(22)
 - 22. Calyx greatly enlarged in fruit, enveloping at least half of the berry; fruit brownish green at maturity.21. *S. sarrachoides*
 - 22. Calyx not enlarged and enveloping the berry; fruit purplish black at maturity.(23)
- 23. Seeds mostly > 1.8 mm long; calyx lobes subequal in fruit.
 -22. *S. interius*
- 23. Seeds mostly < 1.8 mm long; calyx lobes markedly unequal in fruit.
 -23. *S. ptycanthum*

1. *Solanum capsicoides* All.

Perennial herbs, occasionally woody at the base, to 1.2 m tall, the stems pubescent with minute glandular capitate hairs and very sparsely villous with long jointed hairs, provided throughout with straight, broad based stramineous prickles to 10 mm long. Leaves ovate in outline, the blades repand to pinnately lobed, obtuse at the apex, slightly cordate at the base, 5-15 cm long, 3-12 cm wide; petiole to 5 cm long. Inflorescence short, few flowered. Calyx 5-10 mm long, the triangular-ovate lobes 3-4 mm long, prickly. Corolla white, 10-15 mm long, 12-25 mm in diameter. Stamens subequal, the anthers 3-5 mm long. Fruit scarlet, 20-50 mm in diameter. Seeds orbicular-ovoid, flat, 4.0-5.5 mm long, reticulate. *S. aculeatissimum* auct., non Jacq.

Solanum capsicoides is a member of *Solanum* sect. *Acanthophora*, a group of somewhat weedy species with a center of distribution in southeastern South

America. The species is apparently native to coastal areas of eastern Brazil (Nee 1979), but has become successfully established in open, lowland habitats in many tropical and subtropical areas of the world, including the Atlantic and Gulf coastal plains of the U.S. The only Texas specimens seen are early 20th century collections from Chambers County.

2. *Solanum elaeagnifolium* Cav.

Rhizomatous perennial herbs to 1 m tall, often woody at the base, the stems and branches densely covered with many rayed stellate hairs and sparsely to copiously armed with small acicular prickles to 3 mm long. Leaves narrowly lanceolate to oblong, entire to sinuate or undulate, obtuse at the apex, at the base rounded to tapering, 3-10(-15) cm long, 0.5-2 cm wide, with a few scattered acicular prickles on the midvein below; petioles to 2 cm long. Inflorescence 3 to 7 flowered. Calyx 5 angled, the triangular-ovate, attenuate lobes 6-8 mm long. Corolla blue to violet or rarely white, 20-35 mm in diameter. Anthers equal, 6-9 mm long. Fruit yellowish but turning black with age, 10-15 mm in diameter. Seeds brown, shining, ovoid or oblong, 3-5 mm long, nearly smooth. Chromosome number, $n = 12$. *S. tezense* Engelm. & A. Gray, *S. roemerianum* Scheele.

Solanum elaeagnifolium is widespread throughout much of the southcentral U.S., from Kansas and Missouri south to Louisiana, Texas, Arizona, and adjacent México. It is our most abundant nightshade, occurring in waste places, disturbed soils, and open areas throughout most of the state.

The uncommon white flowered plants are referred to f. *albiflorum* Cockill.

3. *Solanum sisymbriifolium* Lam.

Annual herbs to about 0.8 m tall, the stems villous-pubescent with a mixture of glandular capitate and stellate hairs, armed with straight prickles to 6 mm long. Leaves ovate, the blades to 16 cm long, deeply pinnatifid, the lobes sinuate or again pinnatifid, pubescent above and below with a mixture of glandular capitate and stellate hairs; petioles to 5 cm long. Inflorescence terminal, soon becoming lateral, 3 to 5 flowered. Calyx 10-15 mm long, divided into 5 lanceolate to ovate lanceolate lobes 7-10 mm long. Corolla and anthers not seen. Fruit red, very loosely and completely or incompletely enclosed by the prickly calyx, 15-20 mm in diameter. Seeds yellowish brown, ovoid, flattened, 1.5-2.0 mm long, minutely reticulate.

Solanum sisymbriifolium is a native of Brazil that is occasionally adventive or escaped from cultivation in much of the eastern U.S. In Texas it is known from a 1927 collection from Wood County.

4. *Solanum campechiense* L.

Annual herbs to 0.6 m tall, the stems spreading, greenish, with large stipitate and much smaller sessile stellate hairs, armed with thin walled, yellowish prickles to 20 mm long. Leaves oblong to ovate, the blades more or less entire to somewhat 5 or rarely 7 lobed, the lobes coarsely dentate, obtuse at the apex, cordate basally, 5-12 cm long, 6-7 cm wide, densely pubescent with sessile stellate hairs and prickly along the veins above and below; petioles to 5 cm long. Inflorescence few-flowered. Calyx 6-8 mm long, the lobes ovate-lanceolate, acute, 3-5 mm long, accrescent to the fruit at maturity. Corolla pale violet, 15-20 mm in diameter. Stamens subequal, the anthers 4-5 mm long. Fruit red, 10-15 mm in diameter. Seeds yellowish brown, ovoid, plump, 2.0-2.3 mm long, dorsally tuberculate.

Solanum campechiense is a native of México and the West Indies that has been occasionally collected from fields and disturbed ground in brushlands in the Rio Grande Valley (Cameron, Hidalgo, and Zapata counties) with a disjunct collection from Nueces County.

5. *Solanum rostratum* Dun.

Spreading, taprooted annual herbs to 0.7 m tall, the stems stellate pubescent and densely beset with straight, sometimes broad based, prickles to 8 mm long. Leaves ovate to broadly ovate in outline, the blades 7-16 cm long, once or twice pinnatifid, the ultimate lobes rounded or obtuse, stellate pubescent above and below, and prickly along the main veins below; petioles to 10 cm long. Inflorescence 7 to 12 flowered. Calyx 6-13 mm long with linear lobes 6-10 mm long, nearly hidden by the dense covering of stellate hairs and prickles. Corolla yellow, 25-35 mm in diameter. Anthers unequal, the four uppermost yellow, 6-8 mm long, the lowermost suffused with purple, arcuate, 10-14 mm long. Fruit 9-12 mm in diameter, tightly invested by the prickly, accrescent calyx tube. Seeds dark brown, ovoid, flattened, 2.0-2.6 mm long, minutely foveolate. Chromosome number, $n = 12$.

Solanum rostratum is an aggressive, weedy species native to the south-central U.S. from Nebraska to Texas and south into México, but it is widely adventive elsewhere. It is frequently found in disturbed soils and waste places throughout the state.

6. *Solanum heterodoxum* Dun.

Spreading annual herbs from a slender taproot, to about 0.7 m tall, the stems with scattered glandular capitate hairs and yellow prickles to 8 mm long. Leaves broadly ovate to deltoid in outline, 4-11 cm long, twice pinnatifid, the

ultimate lobes obtuse or rounded, above with a mixture of glandular and eglandular hairs, below with scattered stellate and short stipitate glandular hairs, prickly along the main veins below; petioles to 5 cm long. Inflorescence 5 to 9 flowered. Calyx 10 mm long with lanceolate lobes 7-8 mm long. Corolla violet or blue, 10-17 mm in diameter. Anthers unequal, the four uppermost yellow, 2.5-4.0 mm long, the lowermost purple tinged and about 1 mm longer than the upper anthers. Stigma distinctly capitate. Fruit 9-12 mm in diameter, tightly invested by the prickly, accrescent calyx tube. Seeds dark brown, ovoid, flattened, 2.5-2.9 mm long, minutely foveolate. Chromosome number, $n = 12$.

Whalen (1979) recognized three varieties in *Solanum heterodoxum*: var. *heterodoxum*, var. *novomexicanum* Bartl., and var. *setigeroides* M.D. Whalen. Only var. *setigeroides* is known from Texas, having been collected from El Paso, Hudspeth, and Culberson counties.

Correll & Johnston (1970) included *Solanum heterodoxum* in *S. citrullifolium* A. Braun. The two species are quite distinct, however, being easily distinguished by corolla size (<1.5 cm diam. in *S. heterodoxum* versus >2 cm diam. in *S. citrullifolium*) and stigma morphology (capitate in *S. heterodoxum* versus entire in *S. citrullifolium*).

7. *Solanum citrullifolium* A. Braun

Much branched and spreading taprooted annual herbs to about 0.7 m tall, the stems and branches pubescent with a mixture of simple glandular capitate hairs and a few longer uniseriate hairs, armed with straight yellow prickles 2-7 mm long. Leaves broadly ovate in outline, irregularly bipinnatifid and usually pinnatisect near the base, the lobes obtuse or rounded, 4-10 cm long, glandular pubescent, occasionally with a few long uniseriate hairs above and scattered, stellate hairs below; petioles to 5 cm long. Inflorescence 6 to 10 flowered. Calyx 4-5 mm long with linear-lanceolate lobes 2-3 mm long. Corolla violet or blue, 25-35 mm in diameter. Stamens unequal, the 4 uppermost with yellow anthers 6-10 mm long, the lowermost anther arcuate, violet-tinged terminally, 11-16 mm long. Stigma entire. Fruit 8.5-11.5 mm in diameter, closely invested by the prickly, accrescent calyx tube. Seeds ovoid, flattened, dark brown, 2.3-2.9 mm long. Chromosome number, $n = 12$.

Whalen (1979) recognized three varieties in *Solanum citrullifolium*, two of which occur in Texas. Var. *setigerum* Bartlett is found on various substrates in the Trans-Pecos, and in eastern Chihuahua and western Coahuila; it is characterized by stems that are densely covered with spreading or retrorse acicular prickles. Var. *citrullifolium*, characterized by stems with scattered subulate prickles, is found primarily on igneous soils in the Trans-Pecos and adjacent México, with disjunct populations in the Llano Uplift area. Although Whalen reported var. *citrullifolium* to be very scarce in central Texas, having

been collected only twice since 1930, the last time in 1949, I found the plants to be locally common in disturbed roadside habitats in Burnet County in 1989.

8. *Solanum davisense* M.D. Whalen

Taprooted annual herbs 0.4-0.7 m tall, the stems and branches viscid pubescent with a mixture of simple glandular capitate hairs and fine spreading uniseriate hairs, armed with straight yellow prickles 3-7 mm long. Leaves broadly ovate in outline, 2 to 3 times pinnatifid, the ultimate lobes narrowly deltoid to lanceolate, 5-10 cm long, prickly along the main veins, weakly strigulose above, below with few-rayed stellate and scattered short stipitate glandular hairs; petioles to 3 cm long. Inflorescence 5 to 9 flowered. Calyx 4-5 mm long with linear-lanceolate lobes 2-3 mm long. Corolla violet or blue, 13-20 mm in diameter. Anthers unequal, the 4 uppermost yellow, 4.0-5.5 mm long, the lowermost arcuate, violet tinged at the apex, 5.5-8.5 mm long. Stigma weakly capitate. Fruit 8-10 mm in diameter, closely invested by the prickly, accrescent calyx tube. Seeds ovoid, flattened, dark brown, 2.6-3.0 mm long. Chromosome number, $n = 12$.

Solanum davisense occurs sporadically on igneous soils and in sandy or gravelly streambeds, mostly above 1500 m, in the Davis, Chisos, and Chinati mountains of Trans-Pecos Texas, and in the Sierra del Carmen of adjacent Coahuila, México.

9. *Solanum tenuipes* Bartlett

Spreading perennial herbs from woody or corky roots and rhizomes, 20-70 cm tall, the stems viscid pubescent with a mixture of glandular capitate and spreading uniseriate hairs or occasionally glabrate, armed with widely spaced pale yellow prickles 2-8 mm long. Leaves broadly ovate, to 15 cm long, 2 to 3 times pinnatifid, the ultimate lobes usually rounded or obtuse at the apex, glandular capitate and often with scattered uniseriate eglandular hairs above, below with abundant short stipitate glandular capitate and few to numerous stellate hairs, prickly along the main veins below; petioles to 6 cm long. Inflorescence 6 to 9 flowered. Calyx 5-8 mm long with lanceolate to linear lobes 3-5 mm long. Corolla blue or violet, 25-35 mm in diameter. Anthers unequal, the 4 uppermost yellow, 7-10 mm long, the lowermost tinged with purple apically, arcuate, 12-20 mm long. Fruit wholly enclosed by the prickly accrescent calyx tube or nearly so, 7-10 mm in diameter. Seeds dark brown, reniform, 2.7-3.6 mm long, minutely foveolate. Chromosome number, $n = 12$.

Solanum tenuipes is similar in aspect to *S. citrullifolium*, but can be easily distinguished by its perennial habit, smaller fruits (7-10 versus 8.5-11.5 mm in diameter), and larger seeds (2.7-3.6 versus 2.3-2.9 mm long). The species is found on calcareous or gypseous soils in open desert or semidesert in west Texas and northern México.

Whalen (1979) recognized two varieties in *Solanum tenuipes*, both of which occur in Texas. In var. *tenuipes* the largest leaves are thrice pinnatifid and the seeds 3.1-3.6 mm in length; it is distributed from eastern Coahuila north into Brewster, Terrell, Val Verde, and Maverick counties. Var. *latisectum* M.D. Whalen has leaves only twice pinnatifid and seeds 2.7-3.1 mm long; it is distributed primarily in northern México (Chihuahua, Coahuila, Durango) and adjacent Texas (Presidio, Brewster, Terrell, Crockett, and Maverick counties).

10. *Solanum erianthum* D. Don

Shrubs or small trees to 3 m tall, the young stems velvety tomentose throughout with a dense stellate indumentum. Leaves ovate to ovate elliptic or elliptic, entire, acute to acuminate at the apex, rounded at the base, 5-20 cm long, 2-12 cm wide, densely tomentose with stellate hairs below, less densely vestitured above; petioles to 8.5 cm long. Inflorescence usually terminal, many flowered. Calyx 6-8 mm long, tomentose, with ovate lobes 2.5-3.5 mm long. Corolla white, 15-18 mm in diameter, the lobes ciliate. Anthers equal, 2-3 mm long. Fruit yellow, 10-20 mm in diameter. Seeds yellowish brown, ovoid, flattened, 1.5-2.0 mm long, minutely reticulate. *S. verbascifolium* auct.

Solanum erianthum is distinctive among the Texas species of *Solanum* by its habit and densely tomentose, almost felty leaves. The species is a pantropical weed, widely distributed in the Old and New World. In Texas, it is known from several collections in thickets along the margin of the Resaca del Rancho Viejo in Cameron County and from a single collection in loose sand at the edge of live oak mottes in Kenedy County.

11. *Solanum capsicastrum* Link

Small shrubs to about 0.7 m tall, the stems densely pubescent with small dendritic hairs. Leaves narrowly elliptic to oblanceolate, entire to sinuate or undulate, revolute, obtuse or rounded at the apex, tapering at the base, 1-7 cm long, 0.5-1.5 cm wide, pubescent above and below with short dendritic hairs; petioles to 1 cm long. Flowers solitary or 2-3 in lateral inflorescences. Calyx 6-7 mm long, the lanceolate lobes 3-4 mm long. Corolla white, to 15 mm in diameter. Fruit orange-red or scarlet, 8-10 mm in diameter. Seeds orange-brown, flattened, 2.5-3.5 mm long, minutely reticulate.

Solanum capsicastrum, the false Jerusalem cherry, is a native of Brazil that occasionally escapes from cultivation. In Texas the species has been collected from several localities along the Gulf coastal plain (Harris, Colorado, and Victoria counties).

12. *Solanum carolinense* L.

Rhizomatous perennial herbs to approximately 1 m tall, pubescent throughout with 4 to 8 rayed sessile stellate hairs and armed with stout yellow prickles to 4 mm long. Leaves ovate elliptic to ovate, shallowly lobed or toothed, obtuse to acute at the apex, rounded or cuneate at the base, 3-12 cm long, 1.5-5.0 cm wide, prickly along the veins below; petioles to 1.5 cm long. Inflorescence 3 to 8 flowered. Calyx 5-7 mm long, the lanceolate-acuminate lobes 2.0-3.5 mm long. Corolla pale violet to occasionally white, 20-30 mm in diameter. Anthers equal, 6-8 mm long. Fruit yellow, 10-20 mm in diameter. Seeds yellowish-brown, orbicular-ovate, flattened, 2.2-2.6 mm long, minutely rugose.

Solanum carolinense occurs throughout the eastern U.S. as far west as Minnesota and Texas. In Texas, the species is found primarily on sandy soils of the Piney Woods region, as far west as Grayson, Anderson, and Brazoria counties.

The white flowered plants are known as f. *albiflorum* Benke.

13. *Solanum dimidiatum* Raf.

Rhizomatous perennial herbs to about 1 m tall, the stems and branches densely vestitured with 8 to 12 rayed, often stipitate, stellate hairs and sparingly armed with small stout prickles to 5 mm long. Leaf blades ovate, sinuately 5 to 7 lobed, entire to undulate, rounded at the apex, at the base rounded to truncate or cordate, 6-15 cm long, 5-10 cm wide, both surfaces densely beset with 8 to 12 rayed sessile and stipitate stellate hairs, the midrib below provided with short subulate prickles or these sometimes wanting; petioles stout, to 3 cm long. Inflorescence 4 to 20 flowered. Calyx 7-10 mm long, the 5 or 6 triangular-ovate, acuminate lobes 3-5 mm long. Corolla bluish purple to violet, rarely white, 30-50 mm in diameter. Anthers equal, 8-12 mm long. Fruit pale yellow, 25-30 mm in diameter. Seeds light brown, oval, 3.8-4.3 mm long, minutely rugose. Chromosome number, $n = 12$. *S. torreyi* A. Gray.

Solanum dimidiatum is a prairie species of the southcentral U.S. (Kansas and Missouri south to Texas). It is similar in general aspect to *S. carolinense*, but differs in the presence of stipitate, as well as sessile, stellate hairs on the leaf blades, larger anthers (8-12 mm versus 6-8 mm long), and a larger fruit (2.5-3.0 cm versus 1-2 cm in diameter). Although their ranges in Texas overlap

slightly, *S. dimidiatum* is primarily a species of prairie soils in the central part of the state, while *S. carolinense* is restricted to the sandier soils of east Texas.

The white flowered individuals have been treated as f. *album* (Waterfall) Correll.

14. *Solanum jamesii* Torr.

Stoloniferous and tuber bearing perennial herbs, occasionally becoming suffrutescent, usually to about 0.3 m tall, rarely to 0.5 m, the stems with a mixture of coarse flattened uniseriate hairs and much smaller glandular capitate hairs. Tubers often numerous, globose to ellipsoid, white or light brown, 5-20 mm in diameter. Leaves odd pinnate, to 15 cm long, only rarely with small interstitial leaflets, the rachis somewhat winged; leaflets 7-11, linear oblong to lanceolate, to 6 cm long and 2 cm wide but usually much smaller, strigose with numerous flattened uniseriate hairs and scattered glandular hairs above and below. Inflorescence few flowered, the pedicels distinctly articulate at or above the middle. Calyx 3.5-8.0 mm long, irregularly lobed for about half its length. Corolla white, 15-25 mm in diameter. Anthers equal, 3-4 mm long. Style well exerted beyond the anthers. Fruit purplish black, 8-9 mm in diameter. Seeds not seen.

Solanum jamesii is found at elevations of 1400 m and above in the southwestern U.S. (Arizona, Utah, Colorado, New Mexico, Texas) and adjacent México. In Texas the species is relatively rare in the mountains of the Trans-Pecos (El Paso, Hudspeth, Culberson, and Jeff Davis counties).

15. *Solanum leptosepalum* Correll

Stoloniferous perennial herbs, occasionally becoming suffrutescent, to 0.5 m tall, the stems sparsely appressed strigose throughout or glabrous. Leaves odd pinnate, to 20 cm long, sparsely pubescent at the margins, the interstitial leaflets absent or minute; leaflets 5(7), ovate to ovate-elliptic, the lowermost pair much reduced, to 7 cm long and 3.5 cm wide. Inflorescence few flowered, the pedicels articulate at or well above the middle. Calyx 6-8 mm long, the ovate-lanceolate long acuminate lobes 3-5 mm long. Corolla purplish to white, 20-25 mm in diameter. Anthers equal, 6-8 mm long. Style well exerted beyond the anthers. Fruit not seen, reported by Correll (1952) to be about 15 mm in diameter. Seeds not seen.

Solanum leptosepalum was described by Correll (1952) from a single collection and has since been sporadically collected from the mountains of Trans-Pecos Texas and adjacent Coahuila, México. I am not convinced that the taxon is specifically distinct from the widespread and variable Mexican species *S. verrucosum* Schlecht.

16. *Solanum fendleri* A. Gray

Stoloniferous and tuber bearing perennial herbs, occasionally becoming suffrutescent, to about 0.5 m tall, the stems more or less strigose. Tubers globose to ellipsoid, white or suffused with purple, to 3 cm long. Leaves odd pinnate, to 10 cm long, with or without small interstitial leaflets; principal leaflets 5-9, ovate to oblong elliptic or obovate, at the apex obtuse to acute, to 8 cm long and 3.5 cm wide. Inflorescence 3 to many flowered, the pedicels distinctly articulate well above the middle. Calyx 4-6 mm long, the ovate-lanceolate acuminate lobes 3-4 mm long. Corolla blue or purplish, rarely white, usually less than 30 mm in diameter. Anthers equal, 4-6 mm long. Fruit purplish black, 6-8 mm in diameter. Seeds not seen.

Solanum fendleri is distributed in mountains from Colorado south through Arizona, New Mexico, and Texas to Zacatecas, México. In Texas the species has been collected from Brewster, Culberson, and Jeff Davis counties.

Var. *texense* Correll, restricted to the Davis Mts., is a taller and more open plant than var. *fendleri*. The dense pubescence of the calyx imparts a grayish color to the inflorescence. The white to whitish lavender corolla is more deeply lobed, with narrower and more acute sinuses, and the calyx is irregularly and more deeply lobed than typical.

17. *Solanum triflorum* Nutt.

Taprooted annual herbs, erect or ascending, to 0.4 m tall or long, the stems more or less strigose. Leaves ovate to elliptic, deeply pinnatifid, the lobes linear or nearly so, 1-4 cm long, 0.5-2.0 cm wide, strigose above and below; petioles to 2 cm long. Inflorescence 1 to 3 flowered. Calyx 4-5 mm long with lanceolate lobes 3-4 mm long. Corolla white, 8-10 mm in diameter. Anthers equal, 2.0-2.5 mm long. Fruit green at maturity, 10-15 mm in diameter, containing 4-8 sclerotic granules. Seeds yellowish-brown, ovoid, flattened, 2.0-2.5 mm long, minutely reticulate.

Solanum triflorum is very distinctive by its unarmed, deeply pinnatifid leaves. The species is widely distributed across the western half of the U.S. and is occasionally adventive eastward to the Atlantic states. In Texas it has been collected in Culberson and Hemphill counties.

18. *Solanum pseudocapsicum* L.

Small shrubs to about 1.2 m tall, the stems puberulent with small dendritic hairs or glabrous. Leaves narrowly lanceolate to oblong or oblanceolate, entire or somewhat sinuate, revolute, obtuse or acuminate at the apex, tapering at the base, 2-10 cm long, 0.5-1.5 cm wide, sparsely to densely pubescent with

small dendritic hairs or rarely glabrous; petioles to 1 cm long or the leaves sessile. Flowers solitary or 2-3 in lateral inflorescences. Calyx 4-6 mm long, the deltoid to lanceolate lobes 1.5-3.0 mm long. Corolla white, 10-15 mm in diameter. Anthers equal, 2.5-3.0 mm long. Fruit orange-red or rarely yellow, 10-20 mm in diameter. Seeds yellowish brown, flattened, 2-4 mm long, minutely reticulate.

Solanum pseudocapsicum is a native of the Old World that has become naturalized throughout much of the New World tropics and subtropics. In Texas the species is known from several collections in Jasper County, the most recent dating from 1954.

19. *Solanum triquetrum* Cav.

Erect suffruticose perennials to 0.5 m tall or more commonly scandent and reaching 2 m in length, the young stems somewhat striate, glabrous. Leaves deltoid to cordate, usually hastate or hastately 3 or 5 lobed, the central lobe ovate to lanceolate or linear lanceolate, 0.5-5 cm long, glabrous or with a few short marginal hairs. Inflorescence 2 to 5 flowered, the pedicels articulate at the base. Calyx 1.5-3.0 mm long, the deltoid to linear lanceolate lobes 0.5-1.5 mm long. Corolla white or violet tinged, 10-15 mm in diameter. Anthers equal, 2-4 mm long. Fruit red, 10-15 mm in diameter. Seeds yellowish brown, ovoid, flattened, 2.5-3.5 mm long, rough textured. *S. lindheimerianum* Scheele.

Solanum triquetrum is common on slopes, disturbed ground, and in thickets in central, west, and south Texas and adjacent México, often flowering throughout the year. The species is highly variable, especially in regard to its habit and leaf shape.

20. *Solanum douglasii* Dun.

Perennial herbs or shrubs, usually to about 1 m tall but occasionally to as much as 3 m, the stems sparsely to densely puberulent with simple appressed or subappressed hairs or less often villous with spreading hairs, small glandular capitate hairs often present as well. Leaves ovate to narrowly ovate elliptic, the blades entire to sinuate or irregularly dentate, acute to obtuse at the apex, basally cuneate to subtruncate, 3-8 cm long, 1.5-4.0 cm wide, sparsely to densely strigose above and below; petioles slightly winged, to 3 cm long. Inflorescence 4 to 6 flowered, the flowers usually disposed in umbelliform cymes or occasionally solitary. Calyx 1-2 mm long, with ovate to lanceolate or rounded lobes less than 1 mm long. Corolla white, sometimes tinged with purple, 10-18 mm in diameter. Anthers equal, 2.5-4.9 mm long. Style exerted beyond the anthers by at least 1 mm; stigma only slightly expanded. Fruit purplish black, 5-10 mm in diameter, containing 4-10 sclerotic granules. Seeds

yellowish brown, ovoid, plump, 1.2-1.5 mm long, minutely reticulate. Chromosome number, $n = 12$.

Solanum douglasii is widespread, but infrequent, from Louisiana and Texas to California, south through México to Central America. In Texas the species has been collected from all regions of the state but is poorly represented from the High Plains and Rolling Plains.

Solanum douglasii, *S. sarrachoides* Sendt., *S. interius* Rydb., and *S. ptycanthum* Dun. ex DC. constitute the Texas representatives of the *Solanum nigrum* L. complex (*Solanum* sect. *Solanum*), a taxonomically difficult group of weedy species that are often adventive far from their original habitats (Stebbins & Paddock 1949). Recent studies by Heiser *et al.* (1979), Schilling & Heiser (1979), and Schilling (1981) have helped to clarify the delimitation of the North American members of the complex.

Reports of *Solanum villosum* Mill. from Texas (Correll & Johnston 1970) were based in part on misidentified densely puberulent specimens of *S. douglasii*.

21. *Solanum sarrachoides* Sendt.

Taprooted annual herbs, erect or decumbent, to 0.8 m tall or long, the stems viscid pubescent with uniseriate glandular capitate hairs. Leaves triangular ovate to ovate, entire to undulate or dentate, apically acute, at the base cuneate to truncate, 2-5 cm long, 1-3 cm wide, sparsely glandular pubescent marginally and on the main veins above and below; petioles slightly winged, to 2 cm long. Inflorescence umbellate, 2 to 6 flowered. Calyx 1.5-2.0 mm long, the lanceolate lobes 0.5-1 mm long. Corolla white, 5-7 mm in diameter. Anthers equal, 1.5-2.0 mm long. Fruit brownish green to nearly black, the lower one third to one half loosely invested by the enlarged calyx, 6-10 mm in diameter, containing 5-7 sclerotic granules. Seeds yellowish brown, ovoid, 1.7-2.4 mm long, minutely reticulate. Chromosome number, $n = 12$.

Solanum sarrachoides is a native of South America that is adventive and widespread in fields and disturbed areas throughout much of North America. In Texas the species is known from a single collection in the Chisos Mts. of Brewster County (Sperry 475 [SRSC]). This specimen was misidentified as *S. villosum* Mill., a tetraploid Eurasian member of sect. *Solanum* that, like *S. sarrachoides*, is glandular pubescent, but lacks the enlarged, accrescent calyx. No specimens referable to *S. villosum* have been seen from Texas.

The specific epithet is spelled "*sarachoides*" by some authors.

22. *Solanum interius* Rydb.

Deeply rooted annual or short lived perennial herbs to 0.8 m tall, the stems sparsely to densely strigose. Leaves ovate to triangular ovate or rhombic, entire, undulate or sinuate, apically obtuse, acute or short acuminate, at the base cuneate, rounded, or subtruncate, 3-7(-10) cm long, 1-4 cm wide, sparsely to densely strigose, especially below; petioles slightly winged, to 3 cm long. Inflorescence umbellate, 2 to 6 flowered. Calyx 1.5-2.0 mm long with ovate lobes 1.0-1.5 mm long. Corolla white or blue-violet, occasionally with purple stripes, 15-20 mm in diameter. Anthers equal, 1.6-2.0 mm long. Fruit dull purple-black, 5-10 mm in diameter, containing 2 or rarely 4 sclerotic granules. Seeds yellow to brown, ovoid, flattened, 1.9-2.3 mm long, minutely reticulate. Chromosome number, $n = 12$. *S. nigrum* L. var. *interius* (Rydb.) F.C. Gates.

Solanum interius is found in sandy soils throughout much of the Great Plains, from North Dakota to Idaho, south to Texas and New Mexico. Our collections are primarily from sandy sites in the High Plains (Hartley, Hemphill, Ochiltree, and Wheeler counties) with disjunct collections from Taylor and Jeff Davis counties.

23. *Solanum ptycanthum* Dun. ex DC.

Taprooted annual herbs 0.3-0.6 m tall, rarely to 1 m or more in height, the stems glabrous to moderately strigose, unarmed. Leaves very variable, ovate to ovate lanceolate, entire to sinuate dentate, acute, acuminate, or obtuse at the apex, at the base cuneate or rounded to subcordate, 5-15 cm long, 2-5 cm wide, glabrous to moderately strigose; petioles usually winged, to 4 cm long. Inflorescence umbellate, 2 to 4 flowered. Calyx 1.5-2.0 mm long, unequally 5 lobed, the triangular to lanceolate or rounded lobes 1.0-1.5 mm long, unequal and partially fused in fruit, not reflexed. Corolla white or tinged with purple, 10-15 mm in diameter. Anthers equal, 1.4-1.9 mm long. Fruit purplish black, 5-9 mm in diameter, usually containing 6 or more sclerotic granules. Seeds yellowish brown, ovoid, plump, 1.5-1.9 mm long, minutely reticulate. Chromosome number, $n = 12$.

Solanum ptycanthum is widespread throughout eastern North America, west to North Dakota and Texas. The species is found in most regions of the state in open woodlands, along streams and roadsides, and in waste places.

These plants were treated as *Solanum americanum* Mill. by Correll & Johnston (1970). Heiser *et al.* (1979) have argued, however, that this name should be applied to those plants previously recognized as *S. nodiflorum* Jacq. and that the name *S. ptycanthum* should be used for plants previously referred to as *S. americanum*. Although *S. americanum* (as *S. nodiflorum*) was reported from coastal Texas by Jones *et al.* (1961), I have seen no specimens from the state and do not consider the species to be a member of our flora.

Cultivated species: *Solanum diphyllum* L. is occasionally planted as an ornamental shrub and has been collected from Harris County (Houston) and Travis County (Austin). The species is easily recognized by the 1-2 small, rounded pseudostipular leaves produced at the base of each simple elliptic-ovate leaf and by the subumbellate inflorescences borne on lignified lateral peduncles, these bearing prominent pedicel scars in fruit.

ACKNOWLEDGMENTS

Appreciation is extended to Guy Nesom and Mark Bierner for their critical reviews of the manuscript.

LITERATURE CITED

- Correll, D.S. 1952. Section *Tuberarium* of the genus *Solanum* of North America and Central America. U.S.D.A. Agric. Monogr. 11:1-243.
- Correll, D.S. & M.C. Johnston. 1970. *Manual of the Vascular Plants of Texas*. Texas Research Foundation, Renner, Texas. 1881 pp.
- D'Arcy, W.G. 1973. Flora of Panama. Family 170. Solanaceae. Ann. Missouri Bot. Gard. 60:573-780.
- Edmonds, J.M. 1972. A synopsis of *Solanum* sect. *Solanum* (*Maurella*) in South America. Kew Bull. 27:95-114.
- Heiser, C.B., Jr., D.L. Burton, & E.E. Schilling. 1979. Biosystematic and taxometric studies of the *Solanum nigrum* complex in eastern North America. Pp. 513-527 in J.G. Hawkes, R.N. Lester, & A.D. Skelding, eds., *The Biology and Taxonomy of the Solanaceae*, Academic Press, London, U.K. 738 pp.
- Jones, F.B., C.M. Rowell, Jr., & M.C. Johnston. 1961. Flowering plants and ferns of the Texas coastal bend counties. Welder Wildlife Foundation Publ. B-1, Sinton, Texas. 165 pp.
- Nee, M. 1979. Patterns in biogeography in *Solanum*, section *Acanthophora*. Pp. 569-580 in J.G. Hawkes, R.N. Lester, & A.D. Skelding, eds., *The Biology and Taxonomy of the Solanaceae*, Academic Press, London, U.K. 738 pp.
- Schilling, E.E. 1981. Systematics of *Solanum* sect. *Solanum* (Solanaceae) in North America. Syst. Bot. 6:172-185.

- _____ & C.B. Heiser. 1979. Crossing relationships among diploid species of the *Solanum nigrum* complex in North America. Amer. J. Bot. 66:709-716.
- Stebbins, G.L., Jr. & E.F. Paddock. 1949. The *Solanum nigrum* complex in Pacific North America. Madroño 10:70-81.
- Whalen, M.D. 1979. Taxonomy of *Solanum* sect. *Androceras*. Gent. Herb. 11:359-426.

ARTHRAZON HISPIDUS (POACEAE), NEW TO TEXAS

Larry E. Brown & Jeff Schultz

Spring Branch Science Center Herbarium, 8856 Westview Drive, Houston,
Texas 77055 U.S.A.

ABSTRACT

Arthraxon hispidus (Thunb.) Makino is reported new to Texas from Cass County. This collection is a slight range extension from adjacent localities in Arkansas and Louisiana.

KEY WORDS: *Arthraxon*, Poaceae, Texas

Arthraxon hispidus (Thunb.) Makino, an introduced Asian grass, was found on a roadbank along U.S. highway 59 in Cass County, northeast Texas. The nearest sites to this locality are Claiborne Parish, Louisiana (Allen 1980), and Pike and Clark counties in Arkansas (Smith 1988). Neither Johnston (1989, 1990) nor Hatch *et al.* (1990) listed this species for Texas.

This grass has spread to the following states since Kiger's (1971) distributional summary: West Virginia, Ohio, Kentucky, Indiana (Cusick 1986) and now Texas. Van Welzen (*Blumea* 27:255-300, 1981) has lately revised the genus. It is of interest to note that *Microstegium vimineum* (Trin.) A. Camus, another introduced Asian grass and reported as a frequent associate in other states, was found recently in nearby Bowie Co., Texas (Nixon *et al.* 1987).

Specimen collected: UNITED STATES. Texas: Cass Co., along highway 59, 0.25 mi N of Linden, 22 Sep 1991, Jeff Schultz 0308A (SBSC,TAES). The plants were growing in wet to moist soils in the full sun of an open area. Some associated plants were *Panicum* spp., *Onoclea sensibilis* L., *Vernonia missurica* Raf., and *Helianthus angustifolius* L. Figure 1 is a drawing of this Texas collection.

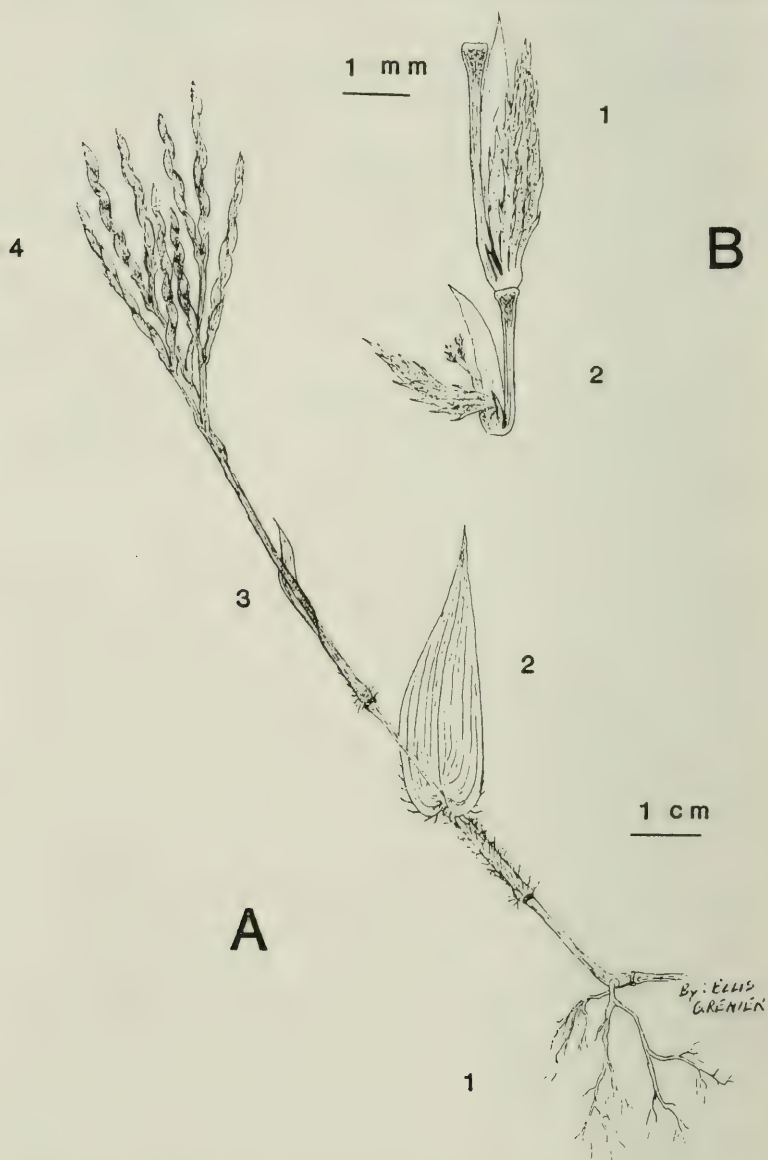


Figure 1. *Arthraxon hispidus*. A. portion of plant with: 1. adventitious roots, 2. foliage leaf, 3. bractlike leaf subtending the inflorescence, 4. inflorescence. B. two spikelets on rachis: 1. closed spikelet, 2. open spikelet. The pedicelled spikelet is reduced to the small pedicel at the base of the spikelet.

ACKNOWLEDGMENTS

We thank Charles Peterson (SBSC) and Kancheepuram N. Gandhi (NCU) for their helpful comments. We also thank Ellis Grenier of Houston Community College for the illustration and Marcia Braun of the Houston Community College Central Library for some technical support.

LITERATURE CITED

- Allen, C.M. 1980. *Grasses of Louisiana*. The University of Southwestern Louisiana, Lafayette, Louisiana.
- Cusick, A.W. 1986. Distributional and taxonomic notes on the vascular flora of West Virginia. *Castanea* 51:56-65.
- Hatch, S.L., K.N. Gandhi, & L.E. Brown. 1990. *Checklist of the Vascular Plants of Texas*. MP-1655. Texas Agric. Expmt. Sta., College Station, Texas.
- Johnston, M.C. 1989, 1990. *A List, Up-dating the Manual of the Vascular Plants of Texas*. Published by the author, Austin, Texas.
- Kiger, R.W. 1971. *Arthraxon hispidus* (Gramineae) in the United States: Taxonomic and floristic status. *Rhodora* 73:39-46.
- Nixon, E.S., S.C. Damuth, & M. McCrary. 1987. Five additions to the Texas flora. *Sida* 12:421-422.
- Smith, E.B. 1988. *An Atlas and Annotated List of the Vascular Plants of Arkansas*, 2nd edition. Published by the Author, Fayetteville, Arkansas.

TWO NEW SPECIES OF *AECHMEA* (BROMELIACEAE)

Harry E. Luther

Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, Florida
34236 U.S.A.

ABSTRACT

Two new species of *Aechmea* are described: *A. haltonii* (subgen. *Podaechmea*) from Panamá and *A. flemingii* (subgen. *Aechmea*) from Guadeloupe.

KEY WORDS: *Aechmea*, Bromeliaceae, Guadeloupe, Panamá

Aechmea flemingii Luther, *sp. nov.* (Figure 1). TYPE: GUADELOUPE. Grande Terre: *Pterocarpus* woods N of La Raizet airport, *Conrad Fleming s.n. legit*, 14 May 1985, (SEL 85-241), flowered in cultivation, 10 July 1991, *H.E. Luther s.n.* (HOLOTYPE: SEL; Isotypes: K,US).

A *Aechmea strobilina* (Buerling) L.B. Smith & R.W. Read, cui affinis, spinis foliorum perminoribus, bracteis florigeris majoribus castaneisque differt.

Plant flowering 0.6 m tall, very densely clustering. Leaves densely rosulate, spreading, 0.8-1.3 m long, bright green. Leaf sheaths elliptic, 13-15 x 8-10 cm, entire, subdensely dark punctate lepidote, somewhat castaneous toward the base abaxially. Leaf blades ligulate, acute to rounded and apiculate, pungent, 3-5 cm wide, laxly and inconspicuously antrorse serrate with dark 0.5 mm long spines, inconspicuously punctate lepidote. Scape erect, mostly concealed within the leaf sheaths. Scape bracts erect, tubular-imbricate, narrowly lanceolate, attenuate, entire, the sheaths castaneous abaxially, the blades green. Inflorescence densely digitate with 4 to 10 branches, 20 x 15 cm, mostly concealed within the rosette. Primary branches lustrous, castaneous, orangish green to bronzyish green, with a pale green margin. Branches subsessile, slightly spreading, each with 1-3 sterile bracts at the base, 8-12 x 3 cm, 10 to 25 flowered. Floral bracts erect, densely imbricate, concealing the rachis and most of

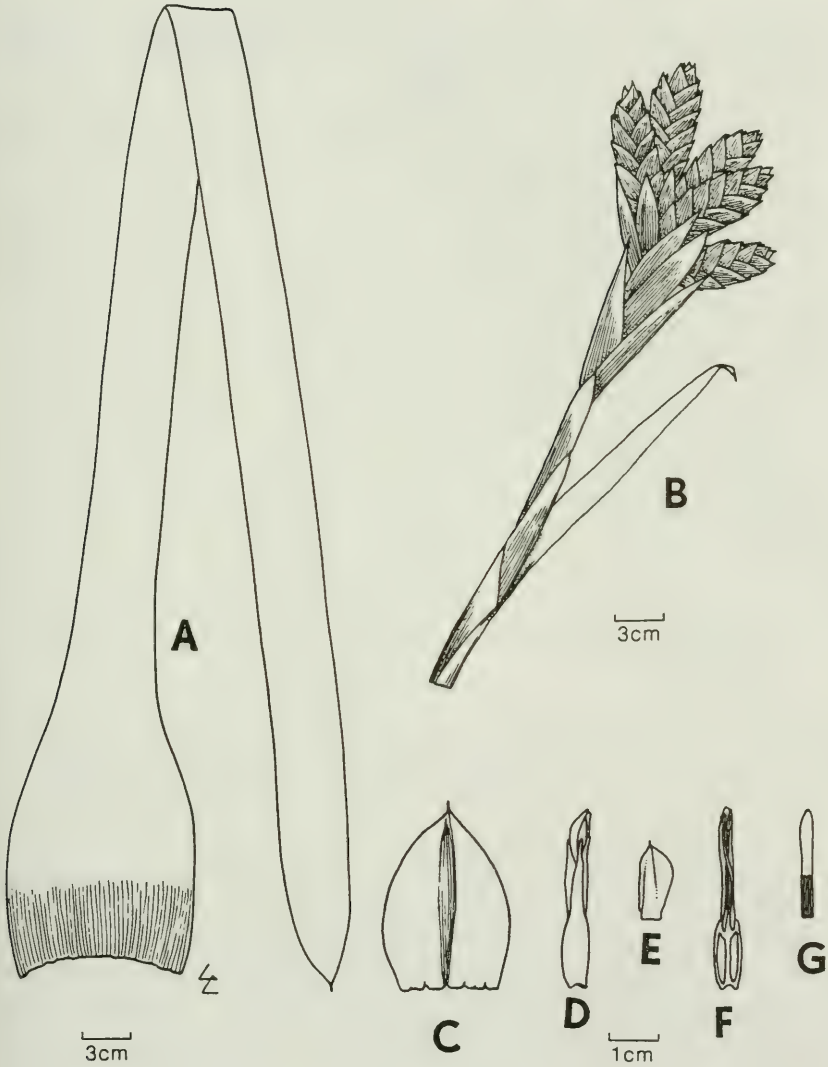


Figure 1. *Aechmea flemingii*. A. leaf. B. inflorescence. C. floral bract. D. flower. E. sepal. F. flower, longitudinal section. G. petal.

the flowers, ovate, acute, mucronate, 32-37 mm long, carinate, coriaceous, pale punctate lepidote especially near the keel, lustrous, orangish green or bronzyish green, drying castaneous with a pale margin. Flowers sessile, erect. Sepals asymmetrical, oblong to obovate, mucronate, 15-17 mm long, the adaxial pair carinate, green. Corolla erect, tubular, barely opening at anthesis. Petals ligulate, obtuse, 20-23 mm long, each with a pair of 7 mm long, basal appendages, bright yellow. Fruit an ellipsoid dark blue berry.

Paratype: GUADELOUPE. type locality, clone of the holotype, 14 May 1985, *Conrad Fleming s.n.* (SEL).

Aechmea flemingii closely resembles *A. strobilina* (Buerling) L.B. Smith & R.W. Read from the Caribbean coast of Panamá, but is clearly distinct due to its small and lax leaf serrations and larger floral bracts. In addition, the primary and floral bracts of *A. strobilina* are brightly colored, (rose red or orange), and the petals are pale (white or cream).

The name honors the collector, Conrad Fleming of St. Croix, Virgin Islands, a well known plantsman.

Aechmea flemingii is evidently a narrow island endemic probably overlooked due to its inconspicuous flowering habit with the inflorescence mostly concealed within its large leafy rosette.

***Aechmea haltonii* Luther, *sp. nov.* (Figure 2). TYPE: PANAMA. Prov. Coclé: El Copé, lithophyte, Aug 1985, *J. Halton s.n.* (HOLOTYPE: SEL).**

A *Aechmea mexicana* Baker, cui affinis, laminis foliorum triangularibus, acutis, pungentibus; scapis bracteis primariisque serratis; sepalis petalisque brevioribus differt.

Plant flowering 0.75-1.50 m tall, clustering. Leaves densely rosulate, erect to spreading, 30 to 45 in number, 35-90 cm long, coriaceous. Leaf sheaths elliptic, 15-25 x 6-15 cm, entire, densely brown punctate lepidote, dark castaneous toward the base abaxially. Leaf blades triangular, acute, pungent, 2-6 cm wide, subdensely serrate with dark 3-8 mm long straight or antrorse spines, subdensely pale punctate lepidote, bright green. Scape erect, 25-65 cm x 8-12 mm, fugaciously white lanate, bright red or pink. Scape bracts elliptic, acute, pungent, serrate, the lowest subfoliaceous, the upper narrowly elliptic, erect and much exceeding the internodes, bright red or pink with green tips. Inflorescence laxly tripinnate, 40-60 x 20-40 cm, many flowered. Primary bracts elliptic, acute, pungent, serrate, exceeding the naked, sterile bases of the branches, often reflexed, gradually diminishing in size toward the apex of the inflorescence, thin coriaceous, nerved, sparsely pale lanuginous lepidote, bright red or pink. Primary branches with a flattened 5-90 mm long, sterile,

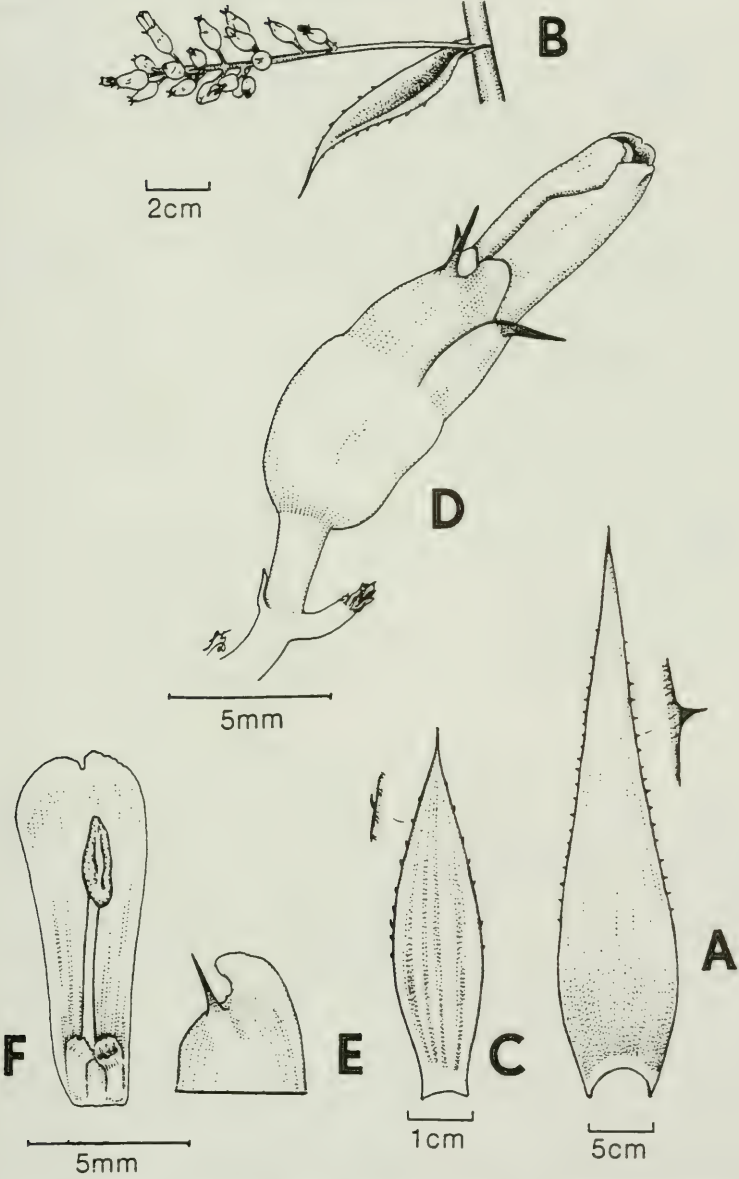


Figure 2. *Aechmea haltonii*. A. leaf, adaxial surface. B. branch of inflorescence. C. primary bract. D. flower. E. sepal. F. petal and stamen.

ebracteate, sparsely pale lepidote base, spreading at 45-90° from the main axis, 2-25 cm long. Secondary branches with a 1-5 mm long base, 1 to 7 flowered. Floral bracts narrowly triangular to filiform, attenuate, 1.00-1.25 mm long, red. Flowers with a slender 2-3 mm long, green, glabrous pedicel, polystichously spreading at ca. 45° from the axis at anthesis. Sepals very asymmetrical, truncate, 4 x 4 mm, the broad lateral wing exceeding the 1 mm long dark terminal mucro, glabrous, green with red margins. Corolla erect, tubular, barely opening at anthesis. Petals oblanceolate, obtuse, or emarginate, slightly cucullate, 10-11 mm long, each with a pair of basal appendages, pink. Ovary ellipsoid, glabrous, pale green, epigynous tube ca. 1 mm deep, placentae apical. Fruit a globose white berry 6-8 mm long.

Paratypes: PANAMA. Type locality, clone of the holotype (SEL 85-1447), flowered in cultivation, 12 Dec 1990, *H. Luther s.n.* (SEL); March 1991, *J. Anderson s.n.* (SEL); 28 Jul 1991, *H. Luther s.n.* (PMA,US); Prov. Veraguas, 2 km above Santa Fe on road to Cerro Negro, 2200 feet, epiphyte, 23 Sep 1991, *C. Skotak s.n.* (SEL).

Aechmea haltonii seems to be most closely related to *A. mexicana* Baker, a species known from México to western Ecuador. It can be immediately distinguished by its triangular and conspicuously dark serrate leaf blades, serrate scape and primary bracts, broader inflorescence, and smaller flowers.

The name honors the original collector, the late Joseph S. Halton, first Display Greenhouse Manager at the Marie Selby Botanical Gardens, who introduced many ornamental and interesting tropical plants to horticulture.

ACKNOWLEDGMENTS

I thank Dr. John T. Atwood and Dr. Gregory K. Brown for their comments on the original draft of the manuscript.

KOSTELETZKYA DEPRESSA, SECTION *KOSTELETZKYA*
(MALVACEAE), NEW TO TEXAS

¹Stanley D. Jones, ²Gretchen D. Jones, & ¹J.K. Wipff

¹S.M. Tracy Herbarium (TAES), Department of Rangeland Ecology and Management, Texas A&M University, College Station, Texas 77843-2126
U.S.A

²Department of Biology, Texas A&M University, College Station, Texas
77843-3258 U.S.A.

ABSTRACT

Kosteletzkya depressa (L.) O. Blanchard, Fryxell, & Bates, section *Kosteletzkya* (Malvaceae) previously unreported in Texas has been found in Cameron County.

KEY WORDS: *Kosteletzkya*, *Kosteletzkya depressa*, section *Kosteletzkya*, Malvaceae, Texas

Kosteletzkya K. Presl, a genus of 17 species, occurs in the New World in North, Central, and South America, and in the Old World from Africa and Madagascar to Europe and Malesia (Fryxell 1988). *Kosteletzkya depressa* (L.) O. Blanchard, Fryxell, & Bates, section *Kosteletzkya*, was first described by Linnaeus (1753) as *Melochia depressa* L. Presl (1835) was the first to move it into the genus *Kosteletzkya*, but failed to use the oldest available specific epithet. Seven others followed in renaming this taxon, maintaining it in the genus *Kosteletzkya*, but it was not until 1978 that the oldest correct epithet was recognized by O. Blanchard, Fryxell, & Bates. For a detailed nomenclatural history, see Fryxell (1988).

Kosteletzkya depressa is reported from southern Florida, the Caribbean Islands, is widely distributed in México including Baja California, and also occurs in South America at least to Ecuador. Cory & Parks (1937), Correll & Johnston (1970), Gould (1975), Hatch *et al.* (1990), nor Richardson (1990) listed *K. depressa* as occurring in Texas, strongly suggesting that this is a recent introduction. Based on previously mapped distributions (Fryxell 1988),

the Cameron County station is approximately 200 air mi. (324 km) from the closest previously known station in southern Tamaulipas, México. There are now two species of *Kosteletzkya* represented in Texas. The following key differentiates them.

KEY TO TEXAS *KOSTELETZKYA*

1. Petals 8 to 12 mm long; calyx 4 to 8 mm long.
 *K. depressa* (L.) O. Blanchard, Fryxell, & Bates
1. Petals 30 to 45 mm long; calyx 8 to 13 mm long.
 *K. virginica* (L.) A. Gray

Our specimen is a robust tap rooted annual about 2 m tall with the lower stem having a conspicuous narrowly rhombic pattern of vasculature (at least when dry). It is much branched above with many diffuse leafy panicles spreading to about 1 m. Flowers are solitary in the leaf axils, rotate, whitish fading to pink. The staminal column is bright yellow. The specimen has stinging trichomes (especially along the lower portion of the plant). The trichomes are of two types, stellate and simple. The simple trichomes are appressed to ascending. The capsules have some scattered stellate trichomes with uncinat trichomes on the margins of the wings. The leaves are lanceolate to hastate with stellate pubescence on both surfaces. The leaves are reduced upwards.

Specimen collected: UNITED STATES. Texas: Cameron Co., 20 October 1991, *S. & G. Jones 7787 & J.K. Wipff* (BRIT,ob[O.J. Blanchard's personal herbarium],PAUH,pf[Paul A. Fryxell's personal herbarium],TEX). The population consists of about ten plants. The collection site is 3.5 mi. (5.7 km) south on Farm Road 1847 from its junction with Farm Road 106, SE of La Tina. The longitude is 97° 28' 00" W and the latitude is 26° 09' 50" N, E of Cross Lake referencing the Laguna Atascosa 7.5' Quad. sheet. The habitat is a low lying drainage area with permanent to semipermanent water with the elevation being about 10 feet (3 m) above sea level. The soils are in the Lomalta series of the Laredo-Olmito association and are specifically Lomalta clay (LM). Permeability is very slow, with the available water capacity low. The soil is dark gray to dark grayish brown, calcareous; slightly to moderately saline. The geology of the site is Alluvium formation (Qas) (Recent). Associated species include *Mimosa pigra* L., *Prosopis glandulosa* Torr., *Cyperus ochraceus* Vahl, *Marsilea macropoda* A. Br., *Borrichia frutescens* (L.) DC., *Polygonum* sp., *Paspalum* sp., and *Eleocharis* sp.

ACKNOWLEDGMENTS

We thank O.J. Blanchard, Jr. (Long Island State University) for verifying our collection and sharing his expertise. We thank Paul A. Fryxell (USDA) for technical directions and reviewing this manuscript, and Robert Lonard (PAUH) for reviewing this manuscript.

LITERATURE CITED

- Correll, D.S. & M.C. Johnston. 1970. *Manual of the Vascular Plants of Texas*. Texas Research Foundation, Renner, Texas.
- Cory, V.L. & H.B. Parks. 1937. *Catalogue of the Flora of Texas*. Texas Agric. Exp. Sta. Bull. 550.
- Gould, F.W. 1975. *Texas Plants—A Checklist and Ecological Summary*. Texas Agric. Exp. Sta. Bull. MP-585.
- Fryxell, P.A. 1988. Malvaceae of México. *Syst. Bot. Monogr.* 25:1-522.
- Hatch, D.L., K.N. Gandhi, & L.E. Brown. 1991. *Checklist of the Vascular Plants of Texas*. Texas Agric. Exp. Sta. Bull. MP-1655.
- Linnaeus, C. 1753. *Species Plantarum*. 674.
- Presl, K.B. 1835. *Reliq. Haenk.* 2:131. t. 70.
- Richardson, A. 1990. *Plants of Southernmost Texas*. Gorgas Science Foundation, Inc., Brownsville, Texas.

NOTES ON NEW INFRASPECIFIC TAXA AND HYBRIDS IN NORTH
AMERICAN *POA* (POACEAE)

R.J. Soreng

L.H. Bailey Hortorium, Cornell University, Ithaca, New York 14853 U.S.A.

ABSTRACT

Five new infraspecific combinations and three new subspecies are proposed. *Poa abbreviata* subsp. *marshii*, *P. arctica* subsp. *lanata*, *P. cusickii* subsp. *purpurascens*, *P. hartzii* subsp. *alaskana*, *P. hartzii* subsp. *ammophila*, *P. laxa* subsp. *banffiana*, *P. pratensis* [subsp. *alpigena*] var. *colpodea*, and *P. secunda* subsp. *juncifolia*. *Poa evagens* is assigned to *Deschampsia caespitosa* subsp. *brevifolia*, and the putative parentage of *P. x fibrata* (*P. pratensis* x *P. secunda* subsp. *juncifolia*) is discussed. Comments on the new taxa, new combinations, relationships of these taxa, additional chromosome counts, and keys are provided.

KEY WORDS: *Poa*, *Deschampsia*, grasses, Poaceae, taxonomy, apomixis, hybrids, polyploidy, North America, arctic, alpine

1. *Poa abbreviata* R. Br. subsp. *marshii* R.J. Soreng, *subsp. nov.* TYPE: U.S.A. Idaho: Blaine Co., Sawtooth Mts., head of Boulder Creek Canyon, 10,000', granite talus, 2 Aug 1937, *J.W. Thompson 14083* (HOLOTYPE: US 1649210!; Isotypes: CAS,CU!,F,GH,NY!,RSA!,WTU) (Fig. 1).

A *P. abbreviata* R. Br. subsp. *abbreviata* et subsp. *pattersonii* (Vasey) A. Löve, D. Löve, & Kapoor lemmatibus glabris et callo arachnideo differt.

Perennial. Culms 5-15 cm tall, slender, from small dense tufts with narrow bases, shoots intravaginal. Upper culm leaf sheath margins fused 1/10-1/4 the length; ligules 1-3 mm long, smooth; blades 1.0-1.5 mm wide, folded and inrolled, lacking papillae, abaxially smooth, adaxially scabrous on and between

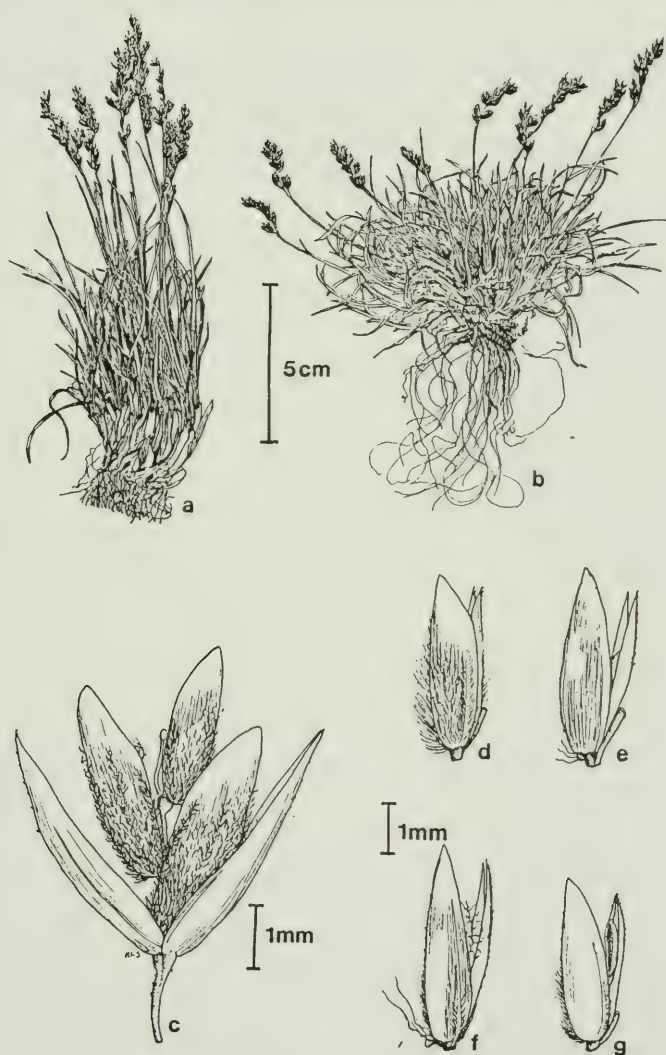


Figure 1. *Poa abbreviata* R. Br. subspp. a. subsp. *marshii* R.J. Soreng, habit (Thompson 14083; HOLOTYPE: US 1649210!). b. subsp. *abbreviata*, habit. c. subsp. *abbreviata*, spikelet. d. floret (Holmen 6626). e. subsp. *marshii*, floret (Hitchcock & Muhlick 11146). f. subsp. *pattersonii*, (Vasey) A. Löve, D. Löve & Kapoor (*jordalii* form), floret (Cantlon & Gillis 57-797). g. subsp. *pattersonii*, floret (Soreng & Spellenberg 1165).

the veins. Panicles 2-5 cm long, lanceolate, the branches scabrous angled. Spikelets with 2-4 florets, 5-6 mm long; glumes subequal, 1-3 veined, the first slightly shorter, second frequently slightly exceeding the lower lemma; calluses of the lower lemmas webbed (sometimes minutely); lemmas 3.5-4.0 mm long, glabrous, smooth; palea keels scabrous; rachillas smooth. Flowers perfect; anthers 0.6-1 mm long.

Habitat. High alpine slopes rocky slopes.

Distribution and Specimens. U.S.A. California (Mono Co., White Mts., *Morefield & Ross 4695.2* RSA!, with subsp. *pattersonii* M. & R. *4695.1* RSA!). Idaho (Blaine Co. [TYPE]; Butte Co., Lemhi Range, Diamond Pk., *Moseley 507* NY!; Custer Co., Lost River Mts., Leatherman Pass, *Hitchcock & Muhlick 11146* CU!, GH, NY!, US, WTU). Nevada (White Pine Co., Shell Creek Range, Shell Pk., *N. Holmgren, Reveal, & Lafrance 2245* NY!).

Subspecies *marshii* is distinguished from all other *Poa abbreviata* only in having entirely smooth, glabrous lemmas (Fig. 1). It was independently described as a subspecies by D.D. Keck in an unpublished manuscript, and by V.L. Marsh, for whom the subspecies is named, in his unpublished dissertation (1950). Both authors cited two collections from Idaho (*Hitchcock & Muhlick 11146*, and *J.W. Thompson 14083*). Three additional specimens of subsp. *marshii* have been discovered in Idaho, Nevada and California. With one exception, subsp. *marshii* is allopatric to other subspecies of *P. abbreviata*, suggesting that the proposed taxon is more than a local population variant or a hybrid.

Recognition of the new subspecies involved restricting the circumscription and reevaluating the geographic range of subsp. *pattersonii* (Vasey) A. Löve, D. Löve, & Kapoor. The latter taxon is frequently confused (as it is in the *Intermountain Flora*) with *Poa glauca* Vahl sensu lato (s. lat.) and *P. secunda* J.S. Presl s. lat. *Poa abbreviata* s. lat. and *P. glauca* can be distinguished from one another with relative ease by observing the base of the plant. The new shoots of *P. abbreviata* develop intravaginally, the bases of both flowering and nonflowering shoots are clothed in sheaths with blades, and the prophylls are generally more than 1 cm long. Most new shoots of *P. glauca* develop extravaginally, breaking laterally out of old sheaths, the basal leaves are bladeless (cataphylls), nonflowering shoots of a season are few in number, and prophylls are generally less than 0.6 cm long. *Poa abbreviata* also has more slender culms and lustrous spikelets. These differences in ramification and aspect are correlated with differences in anther length: 0.2-1.2 mm long in *P. abbreviata*, and 1.2-2.5 mm long in *P. glauca*. The anthers of *P. secunda* are even longer (1.5-3.0 mm), the lemmas are only weakly keeled and never have an isolated single tuft of hair (web) on the dorsal surface of the callus, and the longest panicle branches exceed 1.8 cm in length. (Many specimens previously filed under *P. pattersonii* Vasey have been annotated as other species. Those I have verified as this subspecies are listed below. See also comments under *P. laza*.)

Under this interpretation *P. abbreviata* subsp. *pattersonii* and subsp. *marshii* are only known to be sympatric in the White Mountains of California.

KEY TO THE SUBSPECIES OF *POA ABBREVIATA*

1. Lemmas glabrous; callus of basal florets webbed; U.S.A. California, Idaho, Nevada. subsp. *marshii*
1. Lemmas pubescent; callus of basal florets webbed or not. 2
 2. Lemma intervein regions abundantly pubescent, callus glabrous (rarely distinctly webbed); arctic tundras; circumboreal, north of 60° N (rare in western North America and eastern U.S.S.R.) (map p. 147., Hultén, 1974); $2n = 28, 42, 70, 76$ subsp. *abbreviata*
 2. Lemma intervein regions glabrous or sparsely puberulent, callus frequently webbed; alpine to arctic tundras; Far eastern U.S.S.R. CANADA. Alberta, British Columbia, sw Northwest Territories, Yukon. U.S.A. Alaska, California, Colorado, Montana, Utah, Wyoming; $2n = 42$ subsp. *pattersonii*
2. *Poa abbreviata* R. Br. subsp. *pattersonii* (Vasey) A. Löve, D. Löve, & Kapoor, Arctic & Alpine Res. 3:142. 1971. BASIONYM: *Poa pattersonii* Vasey, Contr. U.S. Natl. Herb. 1:275. 1893. TYPE: U.S.A. Colorado: mts. about the head waters of Clear Creek, 11-14,000', top of Mt. McClellan near Grays Peak, 19 Aug 1885, *Patterson 154* (Isotypes: NY!, US 556757!, US s.n.!).
- Poa jordalii* A. Pors., Canad. Field-Naturalist 79:82, fig. 1. 1965. *Poa abbreviata* R. Br. subsp. *jordalii* (A. Pors.) Hultén, Bot. Not. 126:468. 1973. TYPE: U.S.A. Alaska: south slope of Brooks Range, Bettles River, in alpine tundra on limestone, elev. 2000', *L.H. Jordal 2284* (HOLOTYPE: CAN!; Isotype: US 1980583!).

Chromosome number. $2n = 42$, U.S.A. Montana: Anaconda-Pintlar Wilderness, Mt. Tiny, *Soreng & Spellenberg 1165*; Colorado: Hoosier Ridge, *Soreng et al. 2548*, Mt. Evans, *Soreng et al. 2555*. These three new counts agree with the two previous counts for subsp. *pattersonii* from Colorado (Löve *et al.* 1971), and a report for "subsp. *jordalii*" (A. Pors.) Hultén from the U.S.S.R., as well as the most frequent number reported for subsp. *abbreviata* (Löve & Löve 1975).

Distribution and Verified Specimens. CANADA. Alberta (Waterton Lakes N.P., Avion Ridge, *Breitung 17288* US!). British Columbia (Antimony Mt.,

50° N x 122° W, *Tisdale* 1938 UBC!; Summit Pass, 58° N x 124° W, *Raup & Correll* 10651 CAN!, 10705 CAN!, UBC!, 10704 CAN!). Northwest Territories: District of Mackenzie (Mackenzie Mts., 63° N x 128° W, *Cody* 16690 CAN!; Nahanni N.P., 62° N x 127° W, *Talbot* T 6145 CAN!). Yukon (Sheep Mt., 61° N x 139° W, *Krajina & Hoefs* 1970 UBC!).

U.S.A. Alaska (Kanayut Lake, 68° N x 151° W, *Spetzman* 1958 s.n. US!, US!; Ambresvajun Lake, 68° N x 144° W, *A. & C. Batten* 75-482 CAN!, DAO!; Bettie's River, 67° N x 150° W, *Jordal* 2284 CAN!, US!; Ivishak River, 68° N x 147° W, *Hettinger* 657 CAN!; Jag Mt., 69° N x 144° W, *Cantlon & Gillis* 57-797 CAN!. California (Mono Co., White Mts., *Morefield & Ross* 4695.1 (RSA!). Colorado (Chaffee Co., Mt. Harvard, *Neely & Carpenter* 2349 NY!; Clear Creek Co., Mt. McClellan, 19 Aug 1885, *Patterson* 154, NY!, US!, 23 Aug 1892, *Patterson* 154, US 748851! [*Hitchcock* 1935, fig. 235], Grays Peak, *Shear* 690 1/2 US!, *Swallen* 1407 US!, *Soreng et al.* 2555 NMC!; Gilpin Co., James Peak, *C.F. Cox* 491 US!; Gunnison Co., Conundrum Pass, *J. Barrrell* 70b-55 US; Lake Co., Mt. Elbert, *L. & E. Kelso* 5055 & 5059 DAO!; Larimer Co., Longs Peak, *Hitchcock* 16278 US!, Longs Peak trail, *Ulke* in 1918 [labeled British Columbia] CAN!; Park Co., Mt. Bross, *Weber et al.* 2097 DAO!, Mt. Bross, *E. Hartman & Rottman* 2313; Summit Co., Hoosier Ridge, *Soreng et al.* 2548). Montana (Gallatin Co., Mt. Hyalite, 1 Aug 1902, *Blankinship* s.n. US!, Lava Peak, *Blankinship* s.n. US!; Deer Lodge Co., Mt. Tiny, *Soreng & Spellenberg* 1165 NMC!). Utah (Duchesne Co., Uinta Mts., Kings Peak, *Harrison et al.* 10070 US!; Grand Co., La Sal Mts., Mt. Waas, *Maguire et al.* 16383 CAN!, CU!; San Juan Co., La Sal Mts., Mt. Peal, *Maguire et al.* 16384 CU!). Wyoming (Park Co., Abasroka Mts., *Evert* 6260; Teton Co., Two Ocean Mt., *Hitchcock* 23172 US!; Yellowstone N.P., Soda Butte, *Tweedy* 634 NY!, US!).

U.S.S.R. (Wrangel Island, *Petrovsky & Polozova* 6005 DAO!).

Poa jordalii A. Pors. was based on plants from the Brooks Range of Alaska. The new species was said to lack a web on the callus, and to be pubescent only on the keel and marginal veins of lemmas. However, most of the material from that region has at least a vestige of a web on calluses of basal lemmas (Fig. 1). The web and intervein puberulence are also variable in occurrence in *P. abbreviata* subsp. *pattersonii* of the U.S. Rocky Mountains (Fig. 1). The only characters that I have found to be correlated with geography are: 1) the hairs of the lemma veins are often shorter (0.10-0.15 mm long), and broadened toward the blunt apex, in Alaskan, Yukon, and British Columbia material, as opposed to always longer (0.3-0.5 mm long), not broadened toward the apex, the apex acute in more southerly material; 2) the panicles of the northern plants are more exerted, average 1 cm shorter, and are more sparsely flowered. However, these differences in hairs and panicles are not consistent enough to warrant subspecific distinctions. Hultén reduced *P. jordalii* to a subspecies, commenting that, "It is the Rocky Mountain counterpart to *P. abbreviata*, and

here regarded as a major race of that species." However, *P. abbreviata* subsp. *pattersonii*, established two years earlier, has priority.

Poa abbreviata grades through the *P. jordalii* form toward the closely related *P. lettermanii* Vasey, a more diminutive, yet more commonly occurring species, of similar habitat and range (ranging north to 60° N, British Columbia). *Poa lettermanii* is distinguished from *P. abbreviata* by its lemmas being glabrous or infrequently sparsely puberulent on the base of the keel, shorter (2.5-3.0 mm long), the first and second exceeded in length by both glumes, and anthers being 0.2-0.6 mm long. Its only reported chromosome number, $2n = 14$ (A. Löve, pers. comm.), differs from those reported for *P. abbreviata*. Where the one species stops and the other begins requires closer attention.

3. *Poa arctica* R. Br. subsp. *lanata* (Scribner & Merr.) R.J. Soreng, *comb. et stat. nov.* BASIONYM: *Poa lanata* Scribner & Merr., Contr. U.S. Natl. Herb. 13:72, fig. 16. 1910. TYPE: U.S.A. Alaska: Aleutian Islands, 17 Jul 1899, Coville & Kearney 2191 (HOLOTYPE: US 376421!).

Poa malacantha V. Komarov, Bot. Mat. (Leningrad) 5(10):148. 1924.
TYPE: U.S.S.R. Kamchatka, Komarov 2892 (LE).

Poa komarovii Rosch., Izv. Glavn. Bot. Sada SSSR, 26(3):286. 1927.
TYPE: U.S.S.R. Kamchatka, Komarov 1080 (LE).

Distribution. CANADA. Alberta, British Columbia, Northwest Territories, Yukon. Outside North America. Far eastern arctic U.S.S.R. U.S.A. Alaska. (map and figs., Hultén 1974).

Applying species rank to *Poa lanata* is unworkable. The few characters (e.g., spikelet size, coloration, and rachilla pubescence) said to distinguish *P. lanata* from *P. arctica* are not correlated or grade continuously between the taxa.

Poa malacantha, another taxon in sect. *Poa*, has also been recognized in North America (Hultén 1974; Tzvelev 1983). Tzvelev (1983, English translation) separates *P. malacantha* from *P. lanata* as having "Rachilla almost always somewhat pilose; plants of the Far East [and Alaska], usually forming turf, but often with short creeping underground shoots." versus "Rachilla glabrous; plants [of the northern Far East, including Alaska] with fairly long creeping underground shoots, usually not forming turf." However, these variations and all combinations of them occur in my collections from Alaska and those of UBC, V, and CAN, with no evidence of underlying geographical or ecological pattern. These taxa have almost identical geographic distributions (maps, Hultén 1974). As such, I believe *P. malacantha* to be synonymous with subsp. *lanata*.

KEY TO *POA ARCTICA* SUBSP. *ARCTICA* AND SUBSP. *LANATA*

1. Spikelets mostly greater than 6 mm long; lower lemmas 4.5-6.0 mm long; culm leaf blades often flat and 2-6 mm broad; Far eastern U.S.S.R. CANADA. Alberta, British Columbia, Northwest Territories, Yukon. U.S.A. Alaska. subsp. *lanata*
1. Spikelets less than 6 mm long; lower lemmas 3.0-4.5 mm long; culm leaf blades often folded and less than 2(2.5) mm broad; circumboreal, south to New Mexico in U.S.A. subsp. *arctica* (including: *P. brintnellii* Raup, *P. arctica* subsp. *longiculmis* Hultén, *P. longipila* Nash, and *P. williamsii* Hultén)
4. *Poa cusickii* Vasey subsp. **purpurascens** (Vasey) R.J. Soreng, *comb. et stat. nov.* BASIONYM: *Poa alpina* L. var. *purpurascens* Vasey, *Descr. Cat. Grasses U.S.* 79. 1885. *Poa cusickii* Vasey var. *purpurascens* (Beal) [error for Vasey] C.L. Hitchc., *Vasc. Pl. Pacific Northwest* 1:659. 1969 [(Vasey) C.L. Hitchc. Emend. C.L. Hitchc., *Fl. Pacific Northwest* 659. 1973]. TYPE: U.S.A. Oregon: Mt. Hood, 4000-6000', Aug 1981, T. Howell (HOLOTYPE: US 556826; Isotypes: GH!, ORE!, US 133409!). (map, Soreng 1991.).

Soreng (1991) discussed the nomenclatural problems, morphological variability, and breeding system associated with this taxon and recognized it as *Poa cusickii* Vasey subsp. *epilis* (Scribner) W.A. Weber var. *purpurascens* (Vasey) C.L. Hitchc. The new combination is proposed to be consistent with several floras in progress that restrict the use of more than one infraspecific rank.

5. *Poa laxa* Haenke subsp. **banffiana** R.J. Soreng, *subsp. nov.* TYPE: CANADA. Alberta: Rocky Mountains, vicinity of Sunshine Ski Lodge, south of Healy Creek: Wa-wha Ridge, Standish Hump, alpine slopes and ridges, 7800', 11 Aug 1945, Porsild & Breitung 14092 (HOLOTYPE: CAN!) (Fig. 2).

Poa laxa Haenke var. *occidentalis* Vasey ex Rydb. & Shear?, U.S.D.A. Div. Agrostol. Bull. 5:32. 1897, *nom. nud.* SYNTYPES: U.S.A. Colorado: Grays Peak, Shear 690 and Rydberg 2440. [Not having seen the types of this recently, I can not be certain of its placement here, but several collections from alpine Colorado with narrow, smooth branched panicles, anthers ca. 0.8 mm long, and extravaginal branching closely approach *P. laxa* subsp. *banffiana*].

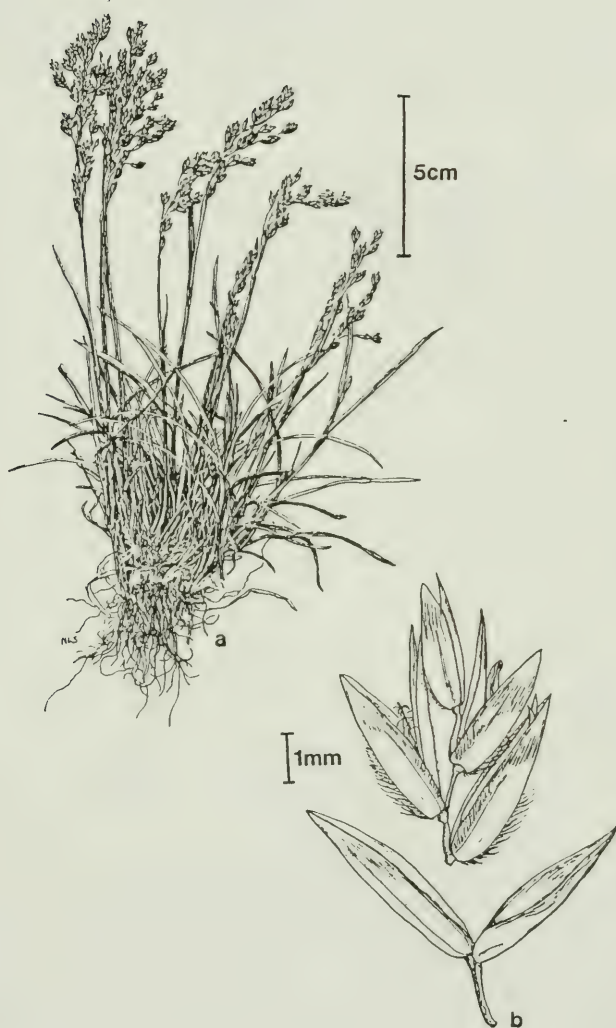


Figure 2. *Poa laza* Haenke subsp. *banffiana* R.J. Soreng. a. habit (Porsild & Breitung 14092; HOLOTYPE: CAN!). b. spikelet (Porsild & Breitung 13960).

A *P. laza* Haenke subsp. *laza*, subsp. *flexuosa* (Smith) Hylander, subsp. *fernaldiana* (Nannf.) Hylander, et *P. paucispicula* Scribner & Merrill callo glabro, lemmatis nervis intermediis puberulis differt. A *P. abbreviata* s. lat. et *P. laza* subsp. *fernaldiana* innovationibus frequenter extravaginalibus differt. A *P. paucispicula* paniculis contractis, ramis 2-4 (nec 1-2) brevioribus differt.

Perennial. Culms 8-25 cm tall, from small tufts, shoots mainly extravaginal, vegetative shoots common and concurrent with the flowering shoots. Upper culm leaf sheath margins fused 1/5-1/3 the length; ligules 2.0-3.5 mm long, acute or lacerate, smooth; blades 1-2(-3) mm wide, flat or folded, prow tipped. Panicle 2.5-8.0 cm long, narrowly open, secund, the branches fairly strict (not flexuous), smooth or sparsely scabrous, 2-3(-5) per node, steeply ascending with 2-6 spikelets, the longest ones 1.2-3.0 cm long. Spikelets with 2-5 florets, 4.0-5.5 mm long; glumes 3 veined, broadly lanceolate, the second glume nearly equal to or longer than the first lemma (ratio 0.92/1-1.13/1); callus glabrous; lemmas 3.0-4.6 mm long, lanceolate, the apex obtuse to acute, distinctly villous on the keel (for at least half the length) and marginal veins, usually sparsely puberulent on the base of the intermediate vein of at least one side of the lemmas, the surface smooth or sparsely finely muriculate; palea keels sparsely scaberulous; rachillas smooth. Flowers perfect; anthers 0.8-1.1 mm long.

Chromosome number. $2n = 84$, meiosis normal (U.S.A. Montana: Glacier N. P., Pigan Pass, *Soreng & Spellenberg 1137* NMC).

Habitat. High alpine, moist ground, slopes, ridges, and ledges.

Distribution and Specimens. CANADA. Alberta (Lake Agnes, *Malte* in 1917; *Porsild & Breitung 13029*, Healy Creek, *13508 & 13513*, Quartz Ridge, *13832*, Citadel Peak, *13960*, Wa-wha Ridge, *14092*, Bow River Pass, *14869 & 14873*, Upper N. Saskatchewan River, *16052*). British Columbia (east side Simpson Pass, *Lid & Porsild 717*; Yoho National Park, Valley of Ten Peaks, *Ulke* in 1922; all the above at CAN!).

U.S.A. Montana (Glacier National Park, *Soreng & Spellenberg 1137*, NMC!).

The identity of my 1980 collection/cytological voucher, *1137*, had plagued me for years until I found a series of matching material at CAN from the northern Rocky Mountains that A.E. Porsild had tentatively set aside as a new species. This series of collections is clearly allied to the *Poa laza* complex of sect. *Oreinos* (Asch. & Graebner) V. Jir., where I believe it is best placed as a new subspecies in *P. laza*.

The presence of subspecies of *Poa laza* s. lat. in North America has long been debated. Nannfeldt (1935) excluded subsp. *flexuosa* (Smith) Hylander, and subsp. *laza* s. str. as strictly European (the former reaching Iceland; the latter strictly continental). He described *P. fernaldiana* Nannf. (*P. laza* subsp. *fernaldiana*) as the eastern North American counterpart.

Polunin (1959) equivocated on the geographic range, including *Poa pseudoabbreviata* Rosch. within his broad delimitation of the species. Scoggan (1978), citing several maps, recognized subsp. *flexuosa* from the coastal regions of northcentral Baffin Isl., Greenland, and Ungava south to Labrador. Porsild & Cody (map 164, 1980) recognize *P. flexuosa* Smith (with the older *P. laza* in synonymy) from scattered locations in eastern Canada south to the Gaspé Peninsula.

Having studied the material called *Poa laza* from North America and Europe at CAN, CU, DAO, NY, and US, I have come to the conclusion that all of their vouchers from the high Nearctic including Greenland called *P. laza* subsp. *flexuosa* (except a few problematical immature specimens from seepage areas on the Ungavian Peninsula, *Wolsenhome s.n.*, from Port Burwell and Wakeham Bay [CAN!!]) are referable to *P. glauca* s. lat. (see also Nannfeldt's rejection of records in the historical literature for *P. glauca* s. lat.; p. 60, 1935). Specimens from the Atlantic Provinces, Labrador and Newfoundland, south to the Gaspé Peninsula, and northern New England are referable to *P. laza* subsp. *fernaldiana*.

Distribution and Representative specimens of *P. laza* subsp. *fernaldiana*: CANADA. Newfoundland (Gros Morne, *Bouchard et al.* 84159 CAN!; Highlands of St. John, Deer Pond Brook, *Fernald & Long* 27405 CU!). Labrador (Lanse au Clair, *Rev. Waghorne* in 1894). Quebec (Matane Co., Mont-Blanc, *Gallo* 1125 DAO!, 1128 DAO!, Mont-Blanc, *Swallen* 3093 CU!; Mt. Logan, *Fernald & Pease* 24878 CAN!, Mt. Fortin, *Fernald & Pease* 24873 CAN!; Gaspé Co., Mt. Blanc, *Swallen* 3471 CAN!, Mt. Jacques-Cartier, *Raymond et al.* 18777 CAN!, *Rolland-Germain* 1178 DAO!, Mt. Le Vieillard, *Fernald et al.* 25445 CAN!, Tabletop Mt., *Scoggan* 1257 CAN!, 1622 CAN!, *Fernald & Collins* 162 CAN!).

U.S.A. Maine (Mt. Katahdin, *Allard* 5212!). New Hampshire (Mt. Washington, numerous collections including the type, *Williams & Robinson Plantae Exsiccatae Grayanae* 123 CU!, and cp-DNA voucher, *Soreng* 3401 CU!; Mt. Lafayette, 31 Jul 1863, *W. Boott* CU!). New York (Mt. Marcy, *Erskins* in 1954, 2n = 42 DAO!). Vermont (Mt. Mansfield, *Woodward* in 1911).

Poa glauca is best distinguished from North American *P. laza* by its uppermost culm sheaths being open 1/10-1/5 their length; pruinose glumes, the second glume being 0.78-0.97 x as long as the first lemma; more firm, densely, finely muriculate lemma surfaces; short, stout, more or less scabrous angled (occasionally smooth) panicle branches; and longest anthers over 1.2 mm long.

The other three subspecies of *Poa laza* exhibit a habit and panicle very similar to those of subsp. *banffiana*, but differ by uniformly smooth panicle branches, and presence of a web on the callus, and (in subsp. *fernaldiana*) by predominantly pseudo-intravaginal innovations (i.e., innovations intravaginal in origin, but with a short prophyll and one or more tubular (intravaginal prophylls are not tubular) bladeless leaves below the first leaf with a blade,

as opposed to a long prophyll and no bladeless leaves), and thinner, often filiform, leaves. Although A.S. Hitchcock reports *P. laza* subsp. *fernaldiana* (*P. fernaldiana*) as lacking a web at the base of the lemmas, I have found a web to be present (though often sparse and short) on at least the lower florets within spikelets of most material.

The new subspecies differs from *Poa pseudoabbreviata* in that the sheaths of the upper culm leaves are open 1/5-1/3 their length; panicle branches are more stout, smooth or only sparsely scabrous, more numerous per node, with more spikelets per branch; lemma pubescence is longer; rachillas are smooth; and anthers are longer. *Poa pseudoabbreviata* has upper culm leaf sheaths open 1/6-1/5 their length; open panicles with distinctly scabrous, elongate, capillary branches bearing 1-2 spikelets; short, 0.05-0.15 mm long lemma pubescence; scabrous rachillas; and anthers 0.2-0.6 mm long (recently revised, and mapped, Cody *et al.* 1990).

Subspecies *banffiana* differs from *Poa paucispicula* in having shorter, more erect, less flexuous panicle branches that are frequently very sparsely scabrous, and have more numerous spikelets, and lemmas sometimes with puberulent intermediate veins (on at least one side) and a glabrous callus. It differs from *P. abbreviata* s. lat. in having panicles more open, with longer, more smooth branches, and high proportion of extravaginal branching.

Subspecies *banffiana* occurs at the southern terminus of the range of *Poa paucispicula*. Porsild & Breitung collected both taxa at Bow River Pass (14875 and 14874 both *P. paucispicula*, 14873 a mixture of the two taxa) and Quartz Ridge (13832). Although subsp. *banffiana* agrees so closely with *P. laza* that it can not be reasonably distinguished, its characteristics are intermediate between those of *P. paucispicula* and *P. abbreviata*, and further investigation may reveal it to be a stable hybrid between the latter species. One strongly webbed specimen from Oregon, and several webless specimens from Colorado, remain indistinguishable from *P. laza* except by their more narrow erect panicles, and these could be placed in *P. abbreviata* subsp. *pattersonii* except for their obvious extravaginal innovations and smooth or nearly smooth panicle branches! (Colorado [Clear Creek Co., Grays Peak, 13000', 15 Aug 1885, *Letterman* s.n. CAN!, Jul 1886, *Letterman* 6 US!, Mt. Evans, Summit Lake, 8 Sept 1956, *Weber* s.n. RSA!; Kingston Peak, *Cox* 487 US!]. Oregon [Wallowa Mts., *Cusick* 2493 CU!, CU!].)

6. *Poa paucispicula* Scribner & Merr., Contr. U.S. Natl. Herb. 13(3):69, fig. 15. 1910. TYPE: U.S.A. Alaska: Yakutat Bay, Hidden Glacier, 20 Jun 1899, *Coville & Kearney* 970 (HOLOTYPE: US 376352!).

Poa merrilliana A. Hitchc., Amer. J. Bot. 2:309. 1915. *Poa glacialis* Scribner & Merr. [not Stapf. in 1906], Contr. U.S. Natl. Herb.

13(3):68. 1910. TYPE: U.S.A. Alaska: Hubbard Glacier, Coville & Kearney 1077 (HOLOTYPE: US 376363!).

Poa merrilliana was described as lacking a web on the callus, and thus could be confused with the new subspecies *P. laxa* subsp. *banffiana*. The type collection of *P. merrilliana* is immature, but does have a distinct, if somewhat sparse, web, and is otherwise indistinguishable from *P. paucispicula* s. str. Most other material at US labeled or annotated by earlier workers as *P. merrilliana* is referable to *P. pseudoabbreviata*.

7. *Poa secunda* J.S. Presl subsp. *juncifolia* (Scribner) R.J. Soreng, *comb. nov.* BASIONYM: *Poa juncifolia* Scribner, U.S.D.A. Div. Agrostol. Bull. 11:52. pl. 8. 1898. *Poa juncifolia* Scribner subsp. *juncifolia* (autonym), established by Keck in C.L. Porter, *Flora Wyom.*, Part 3, Wyoming Agric. Exp. Sta. Bull. 418:22. 1964. TYPE: U.S.A. Wyoming: Sweetwater Co., Point of Rocks, Black Rock Springs, 13 Jul 1897, Nelson 3721 (LECTOTYPE designated in Hitchcock 1935, fig. 262: US 556860!; Isolectotypes: GH!, NY!, NY!, RM!).

Poa nevadensis Vasey ex Scribner, Bull. Torrey Bot. Club 10:66. 1883. TYPE: U.S.A. in 1877, Palmer 474 (Isotypes: NY!, NY!). [The geographical origin of this collection, which has been in doubt, may be Red Creek (now Paragonah), Iron Co., Utah, where Palmer collected 474-1/2 in June (25-) July, 1877, (*P. fendleriana* [Steudel] Vasey subsp. *longiligula* [Scribner & T. Will.] R.J. Soreng)]. Scribner mistakenly believed Red Creek to be in Arizona (Scribner & Williams 1899, p. 3) (see MacVaugh 1956). In 1877, Palmer collected in southwestern Utah, southern Nevada, and northwest Arizona, his numbers are sequential-systematic, and there is no record of his collection notes. My supposition here is that 474 was one collection, subsequently split into two halves.

Poa ampla Merr., *Rhodora* 4:145. 1902. TYPE: U.S.A. Washington: Steptoe, G.R. Vasey 3009 (Isotype: US!).

The only previous application of the rank of subspecies among the approximately 50 taxa currently included in *Poa secunda* s. lat., was by D.D. Keck (1964). He proposed the name *P. juncifolia* subsp. *porteri* Keck, thereby creating the autonym, subsp. *juncifolia*. According to ICBN Article 57.3 (Greuter et al. 1988), the latter name has priority at this rank within any taxon including the type of *P. juncifolia*, unless an earlier epithet of the same rank is found.

Kellogg's studies (1983, 1985) of *Poa secunda* s. lat. demonstrate the futility of attempting to recognize microspecies in geographically parapatric/ecotonally sympatric, facultatively apomictic complexes. Her well considered conclusion that there is only one species agrees with interpretations of Marsh (1952) and Soreng (1985). This is also consistent with the species concept being applied in other such complexes in *Poa* (Tzvelev 1983; Soreng 1991). However, there is substantial variation within *Poa secunda* s. lat., which is indicated by the recognition of up to thirteen species and subspecies by Keck (unpublished manuscript), and by A.S. Hitchcock's (1935) division of what he called eight species into two groups (*Scabrellae* and *Nevadenses*). The latter concept was more or less retained in the *Vascular Plants of the Pacific Northwest* (Hitchcock et al. 1969) and the *Intermountain Flora* (Cronquist et al. 1977).

An intermediate solution to what has been done by others is proposed, recognizing the two major variants as subspecies. When the recorded chromosome numbers are graphed there are peaks at $2n = 84$ and $2n = 63$ (Almgard 1960; Armstrong 1937; Bowden 1961; Hiesey & Nobs 1982; Stebbins & Love 1941). [Subsp. *secunda*: $2n = 42, 44, 56 \times 2, \text{ca.} 61, 62, 63 \times 5, 64, 66, 68, 70 \times 4, 72, 74, 78 \times 2, 80, 81 \times 7, 82 \times 6, 83, 84 \times 23, 85 \times 3, 86 \times 5, 87, 88, 90 \times 2, 91, 93, 94 \times 2^*, 98, 99, 104, \text{ca.} 106$ [82% ≥ 70]. Subsp. *juncifolia*: $2n = 42, 44, 60, 62 \times 7^*, 63 \times 29, 64 \times 11, 65 \times 2, 66, 68 \times 2, 70 \times 3, 78, 84, 96, 97, 100$ [87% ≤ 68 . Two of these counts are new (*, $2n = 63$, Nevada, Soreng 821, $2n$ ca. 94; Montana, Soreng & Spellenberg 1135). The hexaploid *juncifolia* count ($2n = 42$) was added after reassessment of the identity of the voucher specimen (Soreng 1991)]. The nanaploid and duodecaploid peaks correspond to consistent differences in ecology, anatomy, and gross morphology.

Subspecies *secunda* (including *Poa canbyi* [Scribner] Howell, *P. gracilema* Vasey, *P. incurva* Scribner, *P. sandbergii* Vasey, *P. scabrella* [Thurb.] Benth.) has chromosome numbers centered around $2n = 84$. It usually occurs in well drained soils of low salinity or alkalinity. The basal leaf blades are often thin and wither early, a correlate of having long cells that are fusiform in outline with thin, smooth walls. The lemmas are almost invariably softly to crisply puberulent, though in certain individuals or geographic regions the hairs may be extremely sparse, and easily overlooked. Ligules of leaves on sterile shoots are usually acute or acuminate, greater than 2 mm long, and may be glabrous or scabrous.

Subspecies *juncifolia* has chromosome numbers centered around $2n = 63$. It usually occurs in deep, frequently poorly drained, alkaline or saline, soils. The leaf blades are thickened and persistent, a corollary of having some proportion of the long cells rectangular in outline with more or less thickened sinuous walls. The lemmas are glabrous or scabrous, or rarely sparsely and minutely crisp puberulent across the base (the latter puberulent phase is particularly evident on the high plains east of the Rocky Mountains where the taxon may intergrade with *Poa arida* Vasey). Ligules of leaves on sterile shoots are usually

truncate or obtuse, mostly less than 2 mm long, and scabrous (acute, longer, and sometimes glabrous in *P. nevadensis* Vasey forms).

The substantial discontinuity in morphology is evident in that most collectors have distinguished individuals of these two extremes with reasonable success. They do breed true, and the differences are stable in transplant studies. It is the consistent parapatric to ecotonally sympatric occurrence and high frequency of intermediates between these races (I estimate 10-20%) that makes consistent application of species rank impossible.

8. *Poa secunda* J.S. Presl subsp. *juncifolia* (Scribner) R.J. Soreng x *P. pratensis* L.

Poa x *limosa* Scribner & T. Will. (*pro spec.*), U.S.D.A. Div. Agrostol. Circ. 9:5. 1899. TYPE: U.S.A. California: Mono Lake, 1866, Bolander [a rhizomatous plant] (HOLOTYPE: US 748920!).

Poa x *fibrata* Swallen (*pro spec.*), J. Wash. Acad. Sci. 30:210. 1940. TYPE: U.S.A. California: Siskiyou Co., Shasta Valley, 3 mi. south of Grenada, 2600', Wheeler 3629 (HOLOTYPE: US 1646953!; Iso-types: CAS!, NY!).

Apparent hybrids between *Poa pratensis* and *P. secunda* subsp. *juncifolia* are usually sterile anthered intermediates, and occur over much of the geographic range of overlap of the parents. J.T. Howell first suggested that this may be the origin of *P. fibrata* Swallen (*pers. comm.*). I have encountered several sites in California and Oregon, including those investigated in a study of *in vivo* *P. fibrata* for the California Fish & Game Department in 1986, at which both parents and intermediates occur. In addition, I have seen sporadic examples of the nothotaxon from British Columbia and Oregon in herbaria (CAS, OSC, UBC, US, V). Hiesey & Nobs (1982) present ample evidence of the crossing ability of these taxa, and at least temporary stabilization by gametophytic apomixis or vegetative reproduction in F_1 hybrids. Occurrence of counterfeit hybridization should not be ruled out (DeWet *et al.* 1984). The hybrids evidently have had multiple origins, and, as in the case of the type and some other localities of *P. fibrata*, they are sometimes ephemeral.

An older name for *Poa fibrata* is *P. limosa* (there may be older names yet, but finding them would require exhaustive search of some 50 types). Rhizomatous plants like *P. limosa* still grow on the western shores of Mono Lake. Rather than apply a nothotaxon epithet, I suggest that these plants be referred to by their hybrid combination.

9. *Poa pratensis* L. [subsp. *alpigena* (Blytt) Hiit.] var. *colpodea* (Th. Fries) R.J. Soreng, *comb. nov.* BASIONYM: *Poa stricta* Lindeb. subsp.

colpodea Th. Fries, Ofvers. Forh. Königl. Svenska Vetensk.-Akad. 26:138. 1869. *Poa alpigena* (Blytt.) Lindman var. *colpodea* (Th. Fries) Scholand., Skr. Svalbard Ishavet 62:89. 1934. *Poa rigens* R. Br. subsp. *colpodea* (Th. Fries) D. Löve, Taxon 17(1):89. 1968. *Poa pratensis* L. subsp. *colpodea* (Th. Fries) Tzvelev, Novosti Sist. Rast. 9:47. 1972. TYPE: Spitsbergen ("Liefdebay").

Poa alpigena (Blytt.) Lindman f. *vivipara* Rosch. in Komarov [nom. nud.], Fl. U.S.S.R. 2:390. 1934.

Tzvelev (1983) recognized the major ecological forms of the *Poa pratensis* complex as subspecies. *Poa pratensis* s. lat. is a compilospecies, including many facultatively apomictic and reticulating lineages. The character combinations defining each of the major forms overlap and are too subtle and poorly documented to maintain species recognition. Variety *colpodea* is a viviparous form of the high arctic islands and coasts. It occurs at the northern edge of the geographic range of subsp. *alpigena* and extends north of that (map. 7, Hultén 1964). This is well north of any other subspecies of *P. pratensis* in the arctic. The possibility that it is a hybrid between *P. arctica* R. Br. and *P. pratensis* subsp. *alpigena*, is being studied (D. Goldman, S. Aiken, J.I. Davis, R.J. Soreng, unpublished data), as is the possibility that vivipary in var. *colpodea* may be a fixed or plastic response of subsp. *alpigena* to the more extreme northern climate. The morphology of the plants, especially of the sometimes normally developed spikelets within panicles, is typical of subsp. *alpigena*, and is here considered, as it has been by most recent authors, a subset of variation within the latter subspecies.

10. *Poa hartzii* R. Br. subsp. *ammophila* (A. Pors.) R.J. Soreng, *comb. et stat. nov.* BASIONYM: *Poa ammophila* A. Pors., Sargentia 4:12. 1943. TYPE: CANADA. Northwest Territories: District of Mackenzie, Cape Dalhousie, 70° 20' N x 125° 55' W, forming colonies on sandy hills back of coast, 7-14 Aug 1927, A.E. Porsild 2704 (HOLOTYPE: CAN!; Isotype: C!) (fig. 143 and map 158, Porsild & Cody 1980.).

Habitat. Arctic, coastal hills, in sandy to clayey soils and stabilized dunes.

Distribution and Specimens. Continental arctic Canada. Northwest Territories, District of Mackenzie, from Darnley Bay and Cape Parry Peninsula west to the Mackenzie River Delta (69° 20'-70° 20' N x 124°-135° W) (A.E. & R.T. Porsild 2154*, 2311-, 2422*, 2704-, 2827* (all CAN!), Cody & Ferguson 10363- DAO!, Scotter & Zoltai 25592a* DAO! (papillae present = *, absent = -). Porsild & Cody (1980) report it from one collection farther west, in Alaska, but this is probably *Tieszen 854*, which belongs to *Poa hartzii* subsp. *alaskana* R.J. Soreng).

Polunin (1959) and Scoggan (1978) submerged *Poa ammophila* A. Pors. into *P. hartzii*. *Poa hartzii* is a principally Nearctic, high latitude, psammophilic species, occurring on arctic islands from Wrangel Island eastward to Svalbard. Although it is traditionally placed in sect. *Abbreviatae*, its affinities to other species of that section are not strong, and hybrid origins from several different parents have been postulated (Edmondson 1980; Polunin 1959; Tzvelev 1983). Because *P. hartzii* has extravaginal branching, long anthers, somewhat weakly keeled lemmas, and diffuse callus hairs, I suggest it be included in sect. *Secundae* Marsh ex R.J. Soreng. (That section may have had a hybrid origin, but it is distinct from sect. *Abbreviatae* s. str.). Unlike most *Poa* (except sections *Andinae* Nicora, *Secundae*, and *Arctopoa* [Griseb.] Tzvelev), *P. hartzii* has villous hairs distributed around the callus and a smooth transition of the callus into the base of the lemma (fig. 3), the plesiomorphic state in the tribe Poeae (Soreng 1990). Most *Poa* have the derived state of hairs arising from the dorsal side of the callus in a single tuft and a slight sulcus on either side of the web origin of the somewhat laterally compressed callus. (The sulcus and compression are also present in derived species that have lost the web.). The almost invariably sterile, early abortive anthers (lacking any pollen), high, dysploid chromosome numbers ($2n = 63-70$), and lack of obvious morphological variation, in plants from the Canadian Archipelago, arctic coast of Quebec (Cayouette 1984, the first report for the mainland), and Greenland, confirm that *P. hartzii* is predominantly obligately and autonomously apomictic. It has chloroplast-DNA restriction sites diagnostic for *Poa* (R. Soreng, J.I. Davis, & S. Aiken, unpublished data).

Porsild & Cody (1980) maintain that plants from the western continental Canadian arctic are not *Poa hartzii*, but a distinct species, *P. ammophila*. These plants have more normally developed, sometimes pollen bearing anthers (1.5-1.8, vs. aborted and 0.8-1.5 mm long). In addition, they often have papillae on the long cells of the adaxial surface of the leaf blades. They also have shorter ligules (1.5-3.0 mm long), shorter lemmas (3.0-4.6 mm long), elongate rachilla internodes, consistently smooth panicle branches (rarely with a few scabers), a greater tendency to branch intravaginally, and more drab spikelets as compared to *P. hartzii* s. str. (ligules 2-7 mm long, lemmas 3.9-5.3 mm long, panicle branches often scabrous, mixed or predominantly extravaginal branching, and lustrous spikelets). The most consistent characteristics distinguishing subsp. *ammophila* are the lack of hairs on the callus, and the shorter, fine, crisply puberulent hairs of the lemmas (< 0.3 mm long), versus callus hairs present and at least some callus or basal hairs of the lemmas being (0.5-) 0.8-2.0 mm long, and villous. Although the pubescence characteristics are constant elsewhere in the ranges of the two taxa, there is one collection (Porsild's "luxuriant form," 2706 CAN!) from near the type locality of subsp. *ammophila*, which has callus hairs, long lemma hairs, ligules 3 mm long, and lacks papillae. This (and *Parmellee* 3214 from 100 km east of the range of subsp. *ammophila*;

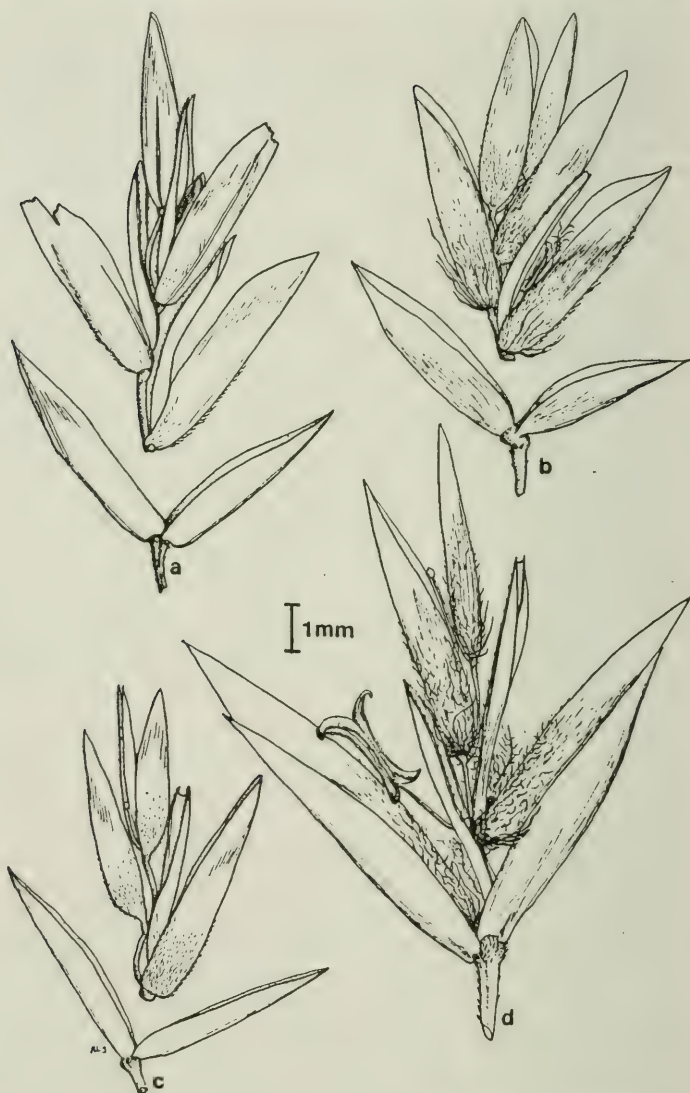


Figure 3. Spikelets of *Poa hartzii* R. Br. subspp. and *P. secunda* J.S.Presl subsp. *secunda*. a. *Poa secunda* subsp. *secunda* (Corcoran 9). b. subsp. *hartzii* (Porsild 18636). c. subsp. *ammophila* (A. Pors.) R.J. Soreng (Porsild & Porsild 2154). d. *P. hartzii* subsp. *alaskana* R.J. Soreng (Murray & Johnson 7153; HOLOTYPE: C!).

69° 35' N x 120° 44' W), is clearly indistinguishable from typical *P. hartzii* and has caused confusion about recognition of subsp. *ammophila*. With the exception of this one plant, from a possibly mixed or polymorphic population, as *P. hartzii*, there is no problem distinguishing these taxa.

However, an additional problem occurs with regard to inland plants collected from around Great Bear Lake, identified as *Poa ammophila* by Porsild & Cody (1980) (*Porsild 17007*- CAN!, and *Corcoran 9*- DAO!). The Corcoran specimen has quite scabrous branches and a habit typical of *P. secunda* and is best placed in *P. secunda* subsp. *secunda* (also identified by D.D. Keck as *P. canbyi* [= *P. secunda*]). In the absence of papillae on the leaf blades (which are variable in occurrence among plants of subsp. *ammophila* from the coast, but also occur in taxa of *Poa* sect. *Secunda* subsect. *Halophytæ* V.L. Marsh ex R.J. Soreng), there is no combination of characters by which to distinguish *17007* from subsp. *ammophila* or *P. secunda*. *Poa secunda* s. lat. is usually distinguished from all other *Poa* by having weakly keeled lemmas. Although the Great Bear Lake specimens have weakly keeled lemmas, so do some specimens of coastal subsp. *ammophila* (also noted by Porsild); keels of lemmas of *P. hartzii* s. str. are not always well defined either. The habits of the plants from the arctic coast and Great Bear Lake regions vary considerably, from spreading and tufted as in *P. hartzii* s. str., to erect and tightly tufted as in *P. secunda*. *Poa secunda* is native as far north as 63-64° N in eastern Alaska, the Yukon and western District of Mackenzie, directly south of the range of subsp. *ammophila*, and often reaches into the alpine. Whether *P. secunda* is native at Great Bear Lake (Sawmill Bay, 65° 43' N, *Corcoran 9*) is not known, but it is entirely possible that its range extends farther north than currently known, into the Mackenzie River delta. Eventually subsp. *ammophila* may be proven to be a hybrid between *P. secunda* and *P. hartzii*.

11. *Poa hartzii* R. Br. subsp. *alaskana* R.J. Soreng, subsp. nov. TYPE: U.S.A. Alaska: 70° 45' N, 156° 30' W, Mead River, forming tufts in sand dunes of point bars, 4 Aug 1980, *D. Murray & Johnson 7153* (HOLOTYPE: C! plant no. 1 [no. 2 = *Deschampsia caespitosa* (L.) Beauv. subsp. *brevifolia* (R. Br.) Tzvelev]; Isotype: ALA) (Fig. 4).

A *P. hartzii* R. Br. subsp. *hartzii* et subsp. *ammophila* (A. Pors.)
R.J. Soreng lemmatibus 5.5-7.0 mm longis, et rhachillis 1.5-2.0 mm
longis, differt.

Perennial; hermaphroditic; cespitose, or becoming stoloniferous in sandy soils. Culms loosely tufted, 20-45 cm tall, innovations intra and extravaginal. Upper culm leaf sheath margins fused 1/7-1/5 the length; ligules 5-7 mm long, smooth to sparsely scabrous abaxially; blades 1-3 mm wide, firm, folded and



Figure 4. *Poa hartzii* R. Br. subsp. *alaskana* R.J. Soreng habit (Murray & Johnson 7153; HOLOTYPE: C!).

inrolled on the margins, smooth abaxially, more or less scabrous to hispidulous adaxially on and between the veins, lacking papillae. Panicle 7-12 cm long, lanceolate, the branches smooth to moderately scabrous, sulcate. Spikelets with 3-5 florets, 5-7 mm long; glumes broadly hyaline, 3 veined, the second glume frequently exceeding the lower lemma; callus with villous hairs 1-2 mm long around the base; lemmas 5.5-7.0 mm long, thin, sparsely villous on the keel and marginal veins and between them, the margins broadly hyaline; palea keels sparsely scabrous to pilose below; rachillas glabrous or sparsely villous, the longest internodes 1.5-2.0 mm long. Flowers perfect; anthers 2.2-2.8 mm long, appearing fertile.

Habitat. High arctic coastal plain, in sands along inland waterways, 100-ca. 850 m.

Distribution and Specimens. U.S.A. Alaska: north slope (Mead River, vicinity of Atkasook village, 70° 39' N, 157° 15' W, *Murray & Johnson* 7153 ALA, C!, *Komarkova & Duffy* 595 COLO, west side of river, 10 mi. north of Atkasook village, in sand dunes, 16 Aug 1959 (1953?), *Cantlon* 4763 CAN!, 4782 CAN!; Mead River delta, *Rothe* 45 ALA; Lake Peters [2800', 69° 20' N, 145° 02' W], up Bear Creek, late snow area in moss bed [roots sandy], 3 Aug 1966, *Tieszen* 854 CAN!). (I have not seen the ALA or COLO specimens, which are cited from location data sent by D. Murray.).

Plants of *Poa hartzii* from the Mead River, northwest Alaska, and Lake Peters, northeast Alaska, are distinguished as subsp. *alaskana*. These are robust (20-45 cm tall), stoloniferous, principally intravaginally branching, have ligules 5-7 mm long, and well developed, pollen bearing anthers 2.0-2.5 mm long. David Murray independently noted some of these distinctions (unpublished manuscript). Plants of subsp. *hartzii* have mostly abortive (empty) anthers, less than 1.5 mm long, ligules 2-5 mm long, shorter stature (15-25 cm tall), a caespitose habit, and proportionally more extravaginal branching. In addition, the Alaskan plants have abundant callus hairs about 2 mm long, and longest lemmas and rachilla internodes that are longer than in subsp. *hartzii* (5.5-7.0 and 1.5-2.0 mm long, versus 3.9-5.3 and 0.8-1.5 mm long, respectively). Like specimens of subsp. *hartzii* checked, the Alaskan plants lack papillae on the leaf blades. The best characters to discriminate between these geographically isolated populations and other *P. hartzii* are fully developed versus early abortive anthers, and the slightly larger looser habit and more vigorous growth of the spikelets. These characters quite likely will be found to overlap. The Alaskan plants may be merely sexually reproducing populations within an otherwise predominantly, obligately apomictic species. The degree of morphological differentiation is consistent with recognition at the subspecific level.

12. *Deschampsia caespitosa* (L.) Beauv. subsp. *brevifolia* (R. Br.) Tzvelev in Tolmachev, *Fl. Sev.-Vost. Europ. Chasti SSSR* 1:141. 1974.

Poa evagens Simmons, Report Second Norw. Arctic Exped. in the Fram 1898-1902. *Kristiana* 2:165-166. 1906. TYPE: CANADA. *Ellesmerlandiae meridionalis*, Fram Fjord 76° 23' N, 81° 30' W, *Simmons* 4267 (LD!).

The name *Poa evagens* has been applied to material of *P. hartzii* subsp. *hartzii* and subsp. *ammophila* by several botanists. An examination of the type specimen of *P. evagens* by myself and S. Aiken revealed that the taxon belongs to *Deschampsia*, not *Poa*; the early deciduous awns probably having contributed to the confusion.

The following infrageneric taxa in *Poa*, proposed by Soreng (1991), are emended here. Three were incorrect according to the *ICBN* (Greuter *et al.* 1988). Subgeneric taxa other than those that include the type of the genus in which they are described, are not autonymic; each rank, even though repetition of the epithet is recommended, is independent of those in which they are included and must be separately validated (see Articles 6.8, 57 and extensions thereof). Thus taxa 14 and 17 need their types and authors repeated. Creation of new subgeneric taxa also requires that the genus be explicitly stated in the protocol (Articles 21.1 and 37). Taxa 13, 15, and 16, but not 14, 17 and 18, were validated by their usage in text and tables in Soreng (1991).

13. *Poa* L. subgen. *Poa* sect. *Madropoa* R.J. Soreng, *Syst. Bot.* 16(3):512-513. 1991. TYPUS: *Poa piperi* A. Hitchc.
14. *Poa* L. subgen. *Poa* sect. *Madropoa* R.J. Soreng subsect. *Madropoa* R.J. Soreng, *Syst. Bot.* 16(3):513. 1991. TYPUS: *Poa piperi* A. Hitchc. Emend.
15. *Poa* L. subgen. *Poa* sect. *Madropoa* R.J. Soreng subsect. *Epiles* A. Hitchc. *ex* R.J. Soreng, *Syst. Bot.* 16(3):512-513. 1991. TYPUS: *Poa epilis* Scribn.
16. *Poa* L. subgen. *Poa* sect. *Secundae* V.L. Marsh *ex* R.J. Soreng, *Syst. Bot.* 16(3):513, 523. 1991. TYPUS: *Poa secunda* J.S. Presl.
17. *Poa* L. subgen. *Poa* sect. *Secundae* V.L. Marsh *ex* R.J. Soreng subsect. *Secundae* R.J. Soreng, *Syst. Bot.* 16(3):523. 1991. TYPUS: *Poa secunda* J.S. Presl. Emend.
18. *Poa* L. subgen. *Poa* subsect. *Halophytæ* V.L. Marsh *ex* R.J. Soreng, *Syst. Bot.* 16(3):523. 1991. TYPUS: *Poa unilateralis* Scribn. Emend.

ACKNOWLEDGMENTS

Thanks are extended to Nancy Soreng for the illustrations, Susan Aiken, Jerrold Davis, and Melissa Luckow for careful readings of the manuscript, Susan Aiken for providing live material of arctic *Poa* and assisting me in the annotation of most of the CAN *Poa*, Rupert Barneby for help with the Latin, David Murray for comments on the Alaskan taxa, John Strother for help with nomenclature, David Keck for his annotation lists of *Poa*, the curators of C, CAN, CU, DAO, LD, NY, RSA, UBC, US, and V for loans of specimens consulted in this study, and Vernon Leroy Marsh, wherever he may be, for his dissertation on *Poa*.

LITERATURE CITED

- Almgard, G. 1960. Experiments with *Poa* I. Studies of *Poa longifolia* Trin. as a fodder grass and as a component in interspecific hybrids. K ngl. Svenska Lantbr.- Acad. Ann. 26:77-119.
- Armstrong, J.M. 1937. A cytological study of the genus *Poa* L. Canad. J. Res. 15:281-297.
- Bowden, W.M. 1961. Chromosome numbers and taxonomic notes on northern grasses IV. Tribe Festuceae: *Poa* and *Puccinellia*. Canad. J. Bot. 39:123-138.
- Cayouette, J. 1984. Additions et extensions d'aire dans la flore vasculaire du Nouveau-Quebec. Naturaliste Canad. 111:263-274.
- Cody, W.J., S.J. Darbyshire, & C.E. Kennedy. 1990. A bluegrass, *Poa pseudoabbreviata* Roshev., new to the flora of Canada, and some additional records from Alaska. Canad. Field-Naturalist 104:589-591.
- Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal, P.K. Holmgren. 1977. *Intermountain Flora*, vol. 6. Columbia University Press, New York, New York.
- DeWet, J.M.J., C.A. Newell, & D.E. Brink. 1984. Counterfeit hybrids between *Tripsacum* and *Zea* (Gramineae). Amer. J. Bot. 71:245-251.
- Edmondson, J.R. 1980. *Poa* L. In T.G. Tutin, V.H. Heywood, N.A. Burges, D.M. Moore, D.H. Valentine, S.M. Walters, & D.A. Webb, [eds.], *Flora Europaea*, vol. 5, 159-167. Cambridge University Press, Cambridge, U.K.

- Greuter, W., *et al.* (eds). 1988. *International Code of Botanical Nomenclature*. Regnum Veg. 118:1-328.
- Hiesey, W.M. & M.A. Nobs. 1982. Experimental studies on the nature of species VI. Interspecific hybrid derivatives between facultatively apomictic species of bluegrasses and their responses to contrasting environments. Carnegie Institution of Washington Publication 636, Washington, D.C.
- Hitchcock, A.S. 1935. *Manual of the Grasses of the United States*. U.S.D.A. Misc. Pub. 200. U.S. Govt. Print. Off., Washington, D.C.
- Hitchcock, C.L., A. Cronquist, M. Ownbey, & J.W. Thompson. 1969. *Vascular Plants of the Pacific Northwest*. University of Washington Publications in Biology 17:648-683, Seattle, Washington.
- Hultén, E. 1964. The circumpolar plants. I. Köngl. Svenska Vetenskapsakad. Handl., Fjarde Ser. 8(5):1-240.
- . 1974. *A Flora of Alaska and Neighboring Territories*. Stanford University Press, Stanford, California.
- Keck, D.D. Unpublished typescript, untitled [a revision of *Poa* of the contiguous western United States], 65 pages, circa 1949. Copies at US and WIS.
- . 1964. *Poa*. Pp. 17-21, in, *A Flora of Wyoming*, part 3, by C.L. Porter. Flora Wyom., Part 3, Wyoming Agric. Exp. Sta. Bull. 418.
- Kellogg, E.A. 1983. A biosystematic study of the *Poa secunda* complex. Ph.D. Dissertation. Harvard University, Cambridge, Massachusetts.
- . 1985. A biosystematic study of the *Poa secunda* complex. J. Arnold Arbor. 66:201-242.
- Löve, A., D. Löve, & B.M. Kapoor. 1971. Cytotaxonomy of a century of Rocky Mountain Orophytes. Arctic and Alpine Res. 3(2):139-163.
- Löve, A. & D. Löve. 1975. *Cytotaxonomical Atlas of the Arctic Flora*. J. Cramer, Leutershausen, Germany.
- MacVaugh, R. 1956. *Edward Palmer, Plant Explorer of the American West*. University of Oklahoma Press, Norman, Oklahoma.
- Marsh, V.L. 1950. A taxonomic revision of the genus *Poa* of the United States and southern Canada. Ph.D. Dissertation. University of Washington, Seattle, Washington.

- . 1952. A taxonomic revision of the genus *Poa* of the United States and southern Canada, part 1. Amer. Midl. Naturalist 47:202-250.
- Nannfeldt, J.A. 1935. Taxonomical and plant-geographical studies in the *Poa laxa* group. Symb. Bot. Upsal. 1(5):1-316.
- Polunin, N. 1959. *Circumpolar Arctic Flora*. Clarendon Press, Oxford, U.K.
- Porsild, A.E. & W.J. Cody. 1980. *Vascular plants of continental Northwest Territories, Canada*. Natl. Mus. Nat. Sci. NM92-71/1979, Natl. Mus. Canad., Ottawa, Ontario.
- Scoggan, H.J. 1978. *The Flora of Canada*, part 2. Natl. Mus. Nat. Sci. 70(2), Natl. Mus. Canad.
- Scribner, F.L. & T. Williams. 1899. *Poa fendleriana* and its allies. U.S.D.A. Div. Agrost. Circ. 10:1-6.
- Soreng, R.J. 1985. *Poa* in New Mexico, with a key to middle and southern Rocky Mountain species (Poaceae). Great Basin Naturalist 45:395-422.
- . 1990. Chloroplast-DNA phylogenetics and biogeography in a reticulating group: Study in *Poa* (Poaceae). Amer. J. Bot. 77(11):1383-1400.
- . 1991. Systematics of the "Epiles" Group of *Poa* (Poaceae). Syst. Bot. 16:507-528.
- Stebbins, G.L. & R.M. Love. 1941. A cytological study of California forage grasses. Amer. J. Bot. 28:371-382.
- Tzvelev, N.N. 1983. *Grasses of the Soviet Union*. [English translation of 1976 Russian ed.] New Delhi: for Smithsonian Institution by Amerind Publishing Company.

FIRST REPORT OF *ERIGERON VELUTIPES* (ASTERACEAE) FROM THE UNITED STATES

Guy L. Nesom

and

Marc A. Baker

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

and

Department of Botany & Microbiology, Arizona State University, Tempe, Arizona 85287 U.S.A.

ABSTRACT

General collections from southern Arizona by the second author have included plants of *Erigeron velutipes* Hook. & Arn., a species previously known only from México.

KEY WORDS: Asteraceae, *Erigeron*, range extension

UNITED STATES. Arizona: Santa Cruz Co., ca. 4 km ESE of Black Peak, just N of fork in road 39, T22S R11E SE 1/4 s.31; moist soil in edge of seep on both sides of road, 27 May 1991, M.A. Baker 8431 (ASU,TEX).

Erigeron velutipes Hook. & Arn. has been collected in relative abundance in México from the states of Michoacán and Jalisco northward along the Pacific coast to Sonora and inland in the northernmost part of its range to western Chihuahua. The closest known collections to the Arizona locality have been made about 500 kilometers to the south in eastcentral Sonora. The Arizona plants and those from around Basaseachic, Chihuahua, are different from most others of the species in their primarily basal stem branching and heads on long, naked, stiffly erect peduncles, but the species includes a great deal of other variability in habit.

In its annual duration, nodding buds, distinctive vestiture, narrow ligules drying blue, and small achenes, *Erigeron velutipes* is similar to *E. lobatus* A.

Nelson and *E. piscaticus* Nesom. The last two are Arizona natives, and details of contrast among these three species are provided in the key in Nesom (1989).

ACKNOWLEDGMENTS

We thank Dr. B.L. Turner and Lindsay Woodruff for their review and comments.

LITERATURE CITED

- Nesom, G.L. 1989. A new species of *Erigeron* (Asteraceae: Astereae) from Arizona. *Phytologia* 67:304-306.

A NEW SPECIES OF *ERIGERON* (ASTERACEAE: ASTEREA) FROM
NORTHWESTERN NEW MEXICO

Guy L. Nesom

Department of Botany, University of Texas, Austin, Texas 78713 U.S.A.

ABSTRACT

A new species of *Erigeron* is described from the Zuni Mountains of McKinley County, New Mexico: *E. sivinskii*. It is most closely related to *E. consimilis* and *E. nematophyllus*.

KEY WORDS: *Erigeron*, Astereae, Asteraceae, New Mexico

Erigeron sivinskii Nesom, *sp. nov.* TYPE: UNITED STATES. New Mexico: McKinley Co., Zuni Mts., E side of Six-Mile Canyon, T14N, R15W, Sec. 18, NW 1/4, 2200 m, several hundred plants on steep, eroded shale slopes of the Chinle Formation, with an abundance of barite nodules on the surface, associated with pinyon-juniper, *Swertia radiata*, *Cryptantha fulvocanescens*, and *Chrysothamnus nauseosus*, 3 Jun 1991, Robert Sivinski & K. Lightfoot 1687 (HOLOTYPE: UNM; Isotype: TEX!).

Erigeronti consimilo Cronq. similis sed differt caulibus foliatis, caulibus foliis phyllariisque sparsim pubescentibus, capitulis minoribus radiis paucioribus, et acheniorum ciliis marginatis leniter evolutis.

Perennial herbs arising from a thick taproot with numerous, short (1-3 cm), ascending-erect caudex branches, the upper portion of these with adherent, old leaf bases. Stems erect, 5-8 cm tall, unbranched, green, sparsely strigose with white, stiff, filiform, closely appressed trichomes evenly distributed and of even length (0.2-0.3 mm long), eglandular. Leaves green, similar in vestiture to the stems, arising in dense basal clusters from the caudex apices, erect to ascending erect, linear, mostly 12-30 mm long, 0.5-0.8 mm wide, definitely thickened, slightly flaring at the very base, the cauline strictly ascending and continuing relatively unreduced in size half way to nearly all the way up the

stems. Heads solitary, terminal, cupulate, 10-14 mm wide (pressed); phyllaries in 2-3 subequal series, 5-6 mm long, linear-lanceolate with acuminate apices, relatively thin herbaceous, narrowly lanceolate with attenuate-filiform apices, minutely but prominently granular-glandular, the outer also sparsely pilose with a few (ca. 10-20 per phyllary), crisped-spreading hairs arising from along the midregion. Ray flowers 21-33, the corollas 7-9 mm long, ligules 1.0-1.5 mm wide, white with a lilac midstripe, distinctly coiling from the apices with maturity. Disc corollas 3.0-3.8 mm long, narrowly funnelform, not strongly inflated or indurated, glabrate; style branches 0.5-0.6 mm long, the collecting appendages deltate to shallowly triangular, 0.1-0.2 mm long. Achenes 2(-3) nerved, narrowly oblong, 2.8-3.1 mm long, the faces glabrous, the margins very sparsely ciliate; pappus of 21-27 barbellate bristles, with a prominent outer series of setae 0.4-0.6 mm long. Known only from the area of the type locality, named for its collector, Robert C. Sivinski, endangered species botanist for the New Mexico Forestry Division.

Additional collections examined: UNITED STATES. New Mexico: McKinley Co., Zuni Mts., Six-Mile Canyon (type locality): 25 May 1990, *Robert Sivinski & A. Cully 1425* (UNM); T14N, R15W, Sec. 7, SW 1/4, several dozen plants on hard, sodic shale outcrop of Chinle Formation, in pinyon-juniper with *Sarcobatus vermiculatus* and *Hilaria jamesii*, 3 Jun 1991, *R. Sivinski & K. Lightfoot 1686* (TEX, duplicate at UNM not seen).

Plants of *Erigeron sivinskii* Nesom are very similar and clearly closely related to those of *E. consimilis* Cronq., which occurs in western Colorado, eastern Utah, and northeastern Arizona. Plants of both taxa produce a taproot with thick caudex branches, linear, erect, and densely massed basal leaves, solitary heads, ray flowers with coiling ligules, achenes with glabrous faces and ciliate margins, and a pappus with a prominent outer series of setae. The vestiture of minute, white, closely appressed trichomes is particularly distinctive and, with the coiling ligules, is a critical factor in the placement of these species in sect. *Wyomingia* (A. Nels.) Cronq. (Cronquist 1947; Nesom 1989). The nature of the relationship between the typical members of this section, however, and the "*E. compactus* group," of which *E. sivinskii* and *E. consimilis* are members, remains unclear.

On the basis of their strong similarity and relatively less marked disparity, Blake (1950) considered *Erigeron consimilis* to be only varietally distinct from *E. compactus* S.F. Blake, which occurs from eastcentral California through Nevada to western Utah. These two taxa also were recently treated as varieties of a single species by Welsh (1983), although neither he nor Blake noted the occurrence of intermediates. According to data given by Welsh (1983) and Albee *et al.* (1988), the two are strongly allopatric in Utah where their ranges approach each other; Welsh characterized their ranges in Utah as "Great Basin" (*E. compactus*) vs. "Colorado Drainage system" (*E. consimilis*). Each of the two taxa is geographically widely distributed, and although the populations of

each appear to be relatively widely isolated, both taxa appear to be constant in the morphological features that distinguish them. Although *E. compactus* is closely similar to *E. consimilis*, Cronquist's initial characterization (1947) of the latter as a separate species remains justifiable.

Erigeron sivinskii occurs near the southeastern corner of the range of *E. consimilis* and can be regarded as a third segment of the *E. compactus*-*E. consimilis* lineage. Compared to *E. sivinskii*, however, *E. consimilis* produces scapose stems, densely invested stems, leaves, and phyllaries, shorter leaves (5-20 mm long), larger heads (15-20 mm wide) with more numerous rays (30-55 per head), and achenes with strongly developed marginal cilia. Even at the closest geographical approach of the two taxa, there is no evidence of intergradation. Further, several features of the McKinley County plants are more similar to another closely related species of the *E. compactus* group of sect. *Wyomingia* (Nesom 1989), *E. nematophyllus* Rydb., which ranges from southwestern Wyoming through western Colorado and into adjacent Utah. As in *E. nematophyllus*, the vestiture of *E. sivinskii* is sparse and the leaves are basal as well as disposed along at least the lower portion of the stem. Thus, while it shares distinctive and probably specialized features of leaf shape and achene vestiture with *E. consimilis*, *E. sivinskii* is more similar to *E. nematophyllus* in leaf disposition and vegetative vestiture. The New Mexico population occurs outside of the geographical range of both its closest relatives, and to best account for its somewhat intermediate morphological position between them, treatment as a separate species is warranted.

Erigeron untermannii Welsh & Goodrich and *E. carringtoniae* Welsh, which were tentatively included in the *E. compactus* group (Nesom 1989), are different in vestiture, leaf shape, and achene pubescence from the species discussed above and are more distantly related, if they belong with the group at all. The following key distinguishes *E. sivinskii* and its closest relatives.

1. Leaves mostly (2-)4-8 cm long, often apically broadened (1.5-2.2 mm wide), the lower margins ciliate; persistent portion of old basal leaves relatively long and slender-fibrous; achene faces pubescent, marginal cilia weakly developed or undifferentiated; outer pappus weakly developed.
 *E. nematophyllus*
1. Leaves mostly 1-3 cm long, usually strictly linear (0.5-1.4 mm wide), eciliate; persistent portion of old basal leaves short and broad; achene faces completely glabrous, marginal cilia present; outer pappus of numerous, prominent setae. (2)
2. Stems, leaves, and phyllaries green, sparsely short strigose; stems with relatively unreduced leaves on at least the lower half; phyllaries relatively thin herbaceous; achene margins sparsely ciliate.
 *E. sivinskii*

2. Stems, leaves, and phyllaries gray-green, densely short strigose; stems essentially scapose, sometimes with a few, small, scattered bracts; phyllaries distinctly thickened along the margins; achene margins densely ciliate. (3)
3. Phyllaries spreading-hispidulous with thick based trichomes; heads 15-20 mm wide; rays 30-55. *E. consimilis*
3. Phyllaries strigose with thin based trichomes; heads 8-15 mm wide; rays 15-32. *E. compactus*

ACKNOWLEDGMENTS

I appreciate the review and comments by Dr. B.L. Turner and Dr. C.R. Werth. Dr. Tim Lowrey brought the McKinley County collection to my attention, and Robert Sivinski sent additional material for study.

LITERATURE CITED

- Albee, B.J., L.M. Shultz, & S. Goodrich. 1988. *Atlas of the Vascular Plants of Utah*. Utah Mus. Nat. Hist. Occ. Publ. No. 7.
- Blake, S.F. 1950. A new combination in *Erigeron*. Leaf. West. Bot. 6:71. 1950.
- Cronquist, A. 1947. Revision of the North American species of *Erigeron*, north of Mexico. *Brittonia* 6:121-302.
- Nesom, G.L. 1989. Infrageneric taxonomy of New World *Erigeron* (Compositae: Astereae). *Phytologia* 67:67-93.
- Welsh, S.L. 1983. Utah flora: Compositae (Asteraceae). *Great Basin Nat.* 43:179-357.

NEW COMBINATIONS IN *POTENTILLA* AND *HORKELIA* (ROSACEAE) IN CALIFORNIA

Barbara Ertter

University and Jepson Herbaria, University of California, Berkeley, California
94720 U.S.A.

ABSTRACT

Three new combinations are proposed for use in the upcoming revised Jepson Manual of California plants. *Potentilla rimicola* (Munz & I.M. Johnston) Ertter replaces *P. wheeleri* subsp. *rimicola*, while *Horkelia californica* subsp. *dissita* (Crum) Ertter and subsp. *frondosa* (E.L. Greene) Ertter replace *H. elata* and *H. frondosa* respectively.

KEY WORDS: *Potentilla*, *Horkelia*, Rosaceae, California, taxonomy

As a result of preparing the treatment of herbaceous Rosaceae for the forthcoming *The Jepson Manual: Higher Plants of California*, several new combinations were found to be necessary. Key characters and descriptions will be found in the Manual and are therefore not included here.

Potentilla rimicola (Munz & I.M. Johnston) Ertter, *comb. et stat. nov.*
BASIONYM: *Potentilla wheeleri* S. Wats. var. *rimicola* Munz & I.M. Johnston, Bull. S. Calif. Acad. Sci. 24:18. 1925.

The *Potentilla wheeleri* complex (Rydberg's *Subviscosae*) includes a series of biogeographically interesting taxa on isolated mountain ranges in California, Arizona, New Mexico, and northern México. Typical *P. wheeleri* occurs from the southern Sierra Nevada to northern Baja California. Although the distinctiveness or circumscription of possible segregates var. *paupercula* Jepson (Mount San Geronio, San Bernardino County, California), *P. luteosericea* Rydb. (northern Baja California), or *P. viscidula* Rydb. (southern Arizona) are thus far uncertain, my initial studies of the complex indicate that at least var. *rimicola* is worth recognizing at the species level. A new combination is therefore needed at this time for the Jepson Manual.

The most distinctive difference between *Potentilla rimicola* and other members of the complex is that it grows in crevices of vertical rock faces; morphological differences include pedicel length and characters of the fruit. *Potentilla rimicola* occurs only in the San Jacinto Mountains of Riverside County, California, and the Sierra San Pedro Mártir of northern Baja California, México. Although *P. wheeleri* occurs in the same mountain ranges, no intergradation between the taxa has been found.

The petrophytic habit is very unusual in *Potentilla* s. str. but characterizes many species of *Ivesia* Torrey & A. Gray (Ertter 1989). These same species of *Ivesia* differ from members of the *P. wheeleri* complex in having pinnately rather than palmately divided leaves, but otherwise share several other intriguing biogeographical and morphological similarities, including glandular hairs, ridged seeds, and \pm recurved pedicels.

Horkelia californica Cham. & Schldl. subsp. *dissita* (Crum) Ertter, *comb. et stat. nov.* BASIONYM: *Potentilla elata* E.L. Greene var. *dissita* Crum in Jepson, *Fl. Calif.* 2:197. 1936.

Potentilla elata E.L. Greene, *Pittonia* 1:100. 1887. *Potentilla californica* (Cham. & Schldl.) E.L. Greene var. *elata* (E.L. Greene) E.L. Greene, *Fl. Franciscana* 1:66. 1891. *Horkelia elata* (E.L. Greene) Rydb., *Bull. Torrey Bot. Club* 25:54. 1898.

Horkelia glandulosa Eastw., *Bull. Torrey Bot. Club* 32:195. 1905.

Horkelia californica Cham. & Schldl. subsp. *frondosa* (E.L. Greene) Ertter, *comb. et stat. nov.* BASIONYM: *Potentilla frondosa* E.L. Greene, *Pittonia* 1:300. 1889. *Horkelia frondosa* (E.L. Greene) Rydb., *Bull. Torrey Bot. Club* 25:54. 1898. *Potentilla californica* (Cham. & Schldl.) E.L. Greene var. *frondosa* (E.L. Greene) Jepson, *Man. Fl. Pl. Calif.* 494. 1925.

Although most treatments during the last few decades treat *Horkelia* (or *Potentilla*) *californica*, *elata*, and *frondosa* as distinct species, this glosses over the large number of intermediate specimens that do not fall conveniently into one taxon or another. Numerous collections from the North Coast ranges of California are particularly frustrating in their intermediacy between typical *H. elata* and typical *H. californica* (e.g., size of leaflets and degree of lobing). Intermediates in leaf morphology also blur the distinctiveness of *H. frondosa*, supporting the treatment of all three as infraspecific taxa.

Unfortunately, the familiar epithet "elata" must be replaced, in that *Potentilla elata* E.L. Greene is a later homonym of *P. elata* Salisb. (*Prodr. Stirp. Chap. Allerton* 1796, p. 362). Britten (1916) argues convincingly that Salisbury's numerous names, although largely superfluous, should not be ignored.

Subspecies are used rather than varieties, both to parallel usage elsewhere in *Horkelia* and to avoid problems caused by the questionable identity of *Potentilla glandulosa* [β] *incisa* Lindl. The possible synonymy with subsp. *frondosa* of this name and the equally problematical *Horkelia grandis* Hook. & Arn. is discussed in detail by Keck (1938).

LITERATURE CITED

- Britten, J. 1916. The plants of Salisbury's "Prodromus" (1796). J. Botany 54:57-65.
- Ertter, B. 1989. Revisionary studies in *Ivesia* (Rosaceae: Potentilleae). Syst. Bot. 14:231-244.
- Keck, D.D. 1938. Revision of *Horkelia* and *Ivesia*. Lloydia 1:75-142. 1938.

BOOKS RECEIVED

Anales del Instituto de Biología, serie Botánica, vol. 61(1). Fernando Chiang C. (ed.). Coordinador de la Biblioteca del Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-233, 04510 México, Distrito Federal, México. 1991. 63 pp. Price unknown (paper). ISSN 0374-5511.

The present volume continues this important series on Mexican botany. It contains a diversity of papers on botanical subjects. These range from description of a new species of *Jatropha* and augmentation of the description of a species of *Quercus*, to effects of plastic mulch on fungal growth in bean cultivation and difficulty of determining presence of mycotoxins in grain sorghum shipments. Also in this issue are papers summarizing the taxonomy, alkaloid chemistry, and ethnobotany of *Datura lanosa*, and a listing of the cryptogamic and graminaceous type specimens in the National Herbarium of México.

Annual Review of Phytopathology, volume 29. R. James Cook (ed.). Annual Reviews, Inc., 4139 El Camino Way, Palo Alto, California 94306. 1991. 516 pp. xii. \$42.00 U.S.A. and Canada (plus G.S.T.), \$47.00 elsewhere (cloth). ISBN 08243-1329-1.

The current volume in this excellent series continues the tradition of comprehensive review articles in the field of phytopathology. A total of 23 papers by 35 authors treat subjects ranging from a historical review of plant pathology as a profession and the changes in the field, to articles on various groups of plant pathogens, to molecular and ecological studies pertaining to phytopathology.

Flora Mesoamericana, Glosario Inglés-Español, Español-Inglés. Fernando Chiang C., Mario Sousa S., & Mario Sousa P. Coordinador de la Biblioteca del Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-233, 04510 México, Distrito Federal, México. 1990. 60 pp. Price unknown (paper). ISBN 968-36-1574-0.

Botanical terms are listed in each language in the two glossaries. This book will be an invaluable resource for English speaking botanists working in Spanish speaking countries, and vice versa. As only 1000 copies were printed, the book may also become very difficult to obtain.

Flora Mesoamericana Glosario para Spermatophyta, Español-Inglés. Mario Sousa S. & Sergio Zárate P. Coordinador de la Biblioteca del Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-233, 04510 México, Distrito Federal, México. 1988 (reprinted from 1983 edition). 88 pp. Price unknown (paper). ISBN 968-36-0827-2.

This book lists and defines (in Spanish) the terms to be used by authors for the *Flora Mesoamericana* project. In addition to the glossary itself, the "index" consists of a listing of English botanical terms with their Spanish translations.

Flowering Bulbs, Indoors and Out. Theodore James, Jr. Photography by Harry Haralambou. MacMillan Publishing Co., 866 Third Avenue, New York, New York 10022. 1991. 150 pp. x. \$29.95 (cloth). ISBN 0-02-558915-6.

Many (over 80) different types of cultivated bulbs are listed in this work. Information on blooming time, hardiness, planting methods, and other features of the plants are included with each entry. The book also contains advice on design and construction of gardens, combinations of bulbs that will provide blooms over extended periods of time. The photographs are of excellent quality.

Gardens of the World. Penelope Hobhouse & Elvin McDonald (consulting editors). MacMillan Publishing Co., 866 Third Avenue, New York, New York 10022. 1991. 262 pp. x. \$39.95 (hardcover). ISBN 0-02-583127-5.

This wonderfully illustrated book provides a whirlwind tour of some famous and some less known gardens of the world. Gardens are grouped within the book by specialization of plant type, style of garden, or orientation of garden. Included are Japanese gardens, rose gardens, tropical gardens, gardens specializing in bulbs, formal gardens, and public gardens. While not technically oriented in a taxonomic or ecological sense, the book is a delight to browse through.

Methods in Stomatal Research. Jonathan Weyers & Hans Meidner. John Wiley & Sons, Inc., Longman Scientific & Technical, 1 Wiley Drive, Somerset, New Jersey 08875-1272 1991. 233 pp. x. \$84.95 (hardcover). ISBN 0-582-03483-3.

This would appear to be an indispensable book for anyone (particularly physiologists) studying stomata. Many methods (from microscopical to microelectrical) are described in the book, for studying stomatal structure and function. In addition to the usefulness for physiologists, ecologists and taxonomists may find this a useful reference work when their research involves stomatal data.

Passion Flowers and Passion Fruit. John Vanderplank. The MIT Press, 55 Hayward Street, Cambridge, Massachusetts 02142. 1991. 176 pp. \$35.00 (hardcover). ISBN 0-262-22043-1.

This well illustrated book treats over 100 of the more commonly cultivated species or *Passiflora*. The text describes and drawings illustrate the general morphological features of members of the genus. Methods of cultivation and propagation are described, as are the major pests and diseases of passion flowers. The bulk of the text consists of summaries of the commonly cultivated taxa. These summaries include morphological descriptions of the plants, notes about their origins, where they will grow, when they flower, and other information useful to anyone wishing to cultivate them. A brief chapter on butterflies that specialize on *Passiflora* is also included. A rather unusual identification key is provided for the included taxa.

Plant Form, An Illustrated Guide to Flowering Plant Morphology. Adrian D. Bell. With line drawings by Alan Bryan. Oxford University Press, 200 Madison avenue, New York, New York 10016. 1991. 341 pp. xiii. \$95.00 (hardcover); \$49.95 (paper). ISBN 0-19-854279-8 (hardcover); 0-19-854219-4 (paper).

This book is abundantly illustrated, with color plates (one or more on nearly every left hand page as the book is opened) to depict subjects described in the text. These are accompanied by line drawings (mostly on the facing page) to clarify structures represented in the photographs. The book has considerable technical merit, treating subjects of root and shoot morphology, phyllotaxy, inflorescence structure, floral morphology, and seed morphology among others. Unfortunately, while the book will be useful to many botanists, the high price will probably prevent its widespread classroom use.

The Book of Garden Design. John Brookes. MacMillan Publishing Company, 866 Third Avenue, New York, New York 10022. 1991. 352 pp. \$40.00 (cloth). ISBN 0-02-516695-6. (paper).

This is a large volume with hundreds of color photographs. Concepts of garden design and style are outlined in the book. This book differs from many others in that architectural symbols and "tricks of the trade" are included here, but absent from other similar works. These are presented in such a way as to encourage individuals to plan their own gardens. The principles of design and illustration discussed in the text are illustrated with photographs and drawings. A relatively limited catalogue of garden plants is included, with the idea of selecting plants to produce specific effects in the garden. The brevity of the plant catalogue is not a serious detriment to this work, since many other books contain much more complete lists of actual and potential garden plants.

The Ecology of Mycorrhizae. Michael F. Allen. Cambridge Studies in Ecology series. Cambridge University Press, 40 West 20th Street, New York, New York 10011. 1991. 184 pp. xii. \$62.50 (hardcover); \$27.95 (paper). ISBN 0-521-33531-0 (hardcover); 0-521-33551-1 (paper).

This book begins with a general introduction to mycorrhizae, in which basics in structure, evolution, physiology, and reproduction of mycorrhizae are treated. Examination of ecology of mycorrhizae ranges from interactions between mycorrhizae and plants, animals, and fungi. Ecological relationships ranging from species/species interactions to communities dynamics, dispersal of mycorrhizae, and mycorrhizae in relation to succession are examined. The book concludes with a chapter on future research on mycorrhizae.

CORRECTIONS AND ADDITIONS

- Volume 70, issue 3, March 1991: page 220, line 7, substitute "*Cistanthe calycina*" for "*Cistanthe calycina*."
- Volume 70, issue 4, April 1991, page 331, line 39, column 2, insert a comma between 234 and 336.
- Volume 70, issue 4, April 1991, page 348, lines 2-3, column 2, insert a new line 3: "*spuria* 3:467."
- Volume 70, issue 4, April 1991, page 349, line 6, column 2, add "3:467" on end of line.
- Volume 70, issue 4, April 1991, page 349, lines 6-7, column 2, insert a new line 7: "*maritima* 3:467."
- Volume 70, issue 4, April 1991, page 360, line 24, column 1, replace "3:277" with "3:227."
- Volume 71, issue 1, July 1991, page 61, lines 36-37, remove "*ssp. et var.*"
- Volume 71, issue 1, July 1991, page 62, line 3, substitute "*simplex* Kunth" for "*glutinosa* Nutt."
- Volume 71, issue 3, September 1991: Contents, inside front cover, line 1, substitute "list" for "checklist."
- Volume 71, issue 4, October 1991: page 330, line 32, substitute "*cochisensis*" for "*chihuahuensis*."
- Volume 71, issue 4, October 1991: page 330, line 33, insert "*ssp. sinuata*" before "*Berberis haematocarpa*."

New York Botanical Garden Library



3 5185 00288 4789

Information for Authors

Articles from botanical systematics and ecology, including biographical sketches, critical reviews, and summaries of literature will be considered for publication in PHYTOLOGIA. Manuscripts may be submitted either on computer diskette, or as typescript. Diskettes will be returned to authors after action has been taken on the manuscript. Diskettes may be 5.25 inches or 3.5 inches and may be written in any IBM or MacIntosh compatible format. Typescript manuscripts should be single spaced and will be read into the computer using a page scanner. The scanner will read standard typewriter fonts but will not read dot matrix print. Manuscripts submitted in dot matrix print cannot be accepted. Use underscore (not italics) for scientific names. Corrections made on typescript manuscripts must be complete and neat as the scanner will not read them otherwise. Language of manuscripts may be either English or Spanish. Figures will be reduced to fit within limits of text pages and therefore, should be submitted with an internal scale and have dimensions proportional to those for text pages. Legends for figures should be included in figures whenever possible. Each manuscript should have an abstract and key word list. Specimen citations should be consistent throughout the manuscript. Serial titles should be cited with abbreviations used in *Botanico Periodicum Huntianum*. References cited only as part of nomenclatural summaries should not appear in Literature Cited. Nomenclatural work should include one paragraph per basionym and must provide proper (as defined by the current *International Code of Botanical Nomenclature*) citation of sources of epithets and combinations.

Authors should arrange for two workers in the appropriate field to review the manuscript before submission. Copies of reviews should be forwarded to the editor with the manuscript. Manuscripts will not be published without review.

Cost of publication is currently \$13.00 US per page for publication without reprints. Publication with 100 reprints is provided for \$18.00 US per page, 200 reprints for \$21.50 US per page. Page charges are due with manuscript and no paper will be published before payment is received in full. Reprints must be ordered and paid for in advance. Page charges will be determined on the basis of a typescript page (single spaced, 10 points, blank line between paragraphs) with all type inside a rectangle 143 mm (horizontal) by 219 mm (vertical), not including running head and page number. Title page should include title, author(s) name(s), and address(es). Two blank lines should appear above and below section headings (Abstract, Discussion, Literature Cited, etc.) in the manuscript. No extra charge is made for line drawings provided they conform to limitations of size and proportion for normal text. Halftones require an extra charge of \$10.00 US per page.